A COMPARISON OF STRESS INOCULATION TRAINING AND STRESS EDUCATION IN THE TREATMENT OF STRESS ASSOCIATED WITH DENTAL PROCEDURES,

by

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INTRODUCTION

Overview of the current study

The current study was designed to test the efficacy of stress inoculation training and stress education for the treatment of stress-related behaviors using a subject population of individuals who reported that they experienced high levels of subjective distress associated with dental treatment. In addition, several assessment techniques were validated for use in the dental context with respect to their ability to discriminate high from low fear subjects.

The remainder of the introduction provides a background for understanding the purpose and rationale of the study. Selye's (1936) original conceptualization of the stress response is discussed and compared to Mason's (1968) reconceptualization. A special emphasis is placed on cognitive theories of stress because of: 1) their close correspondence to Mason's (1968) theory, 2) the promising treatment results obtained in the past using cognitive restructuring strategies, and 3) the apparent importance of cognitions in the assessment of threat. In addition, the literature pertaining to the coping skills utilized in stress inoculation training is reviewed and a description of each coping strategy is provided.

Selye's Theory of Stress

In the more than four decades since Hans Selye began his investigation of biologic stress (Selye, 1936), there has been an explosive growth in the study of stress and its effects on living organisms. During that time, there have been more than 120,000 publications relating to the stress concept, with investigation and
comments coming from such areas of interest as medicine, the behavioral sciences, and philosophy (Selye, 1979).

Exposure to stressful stimuli has been implicated as a causal factor in the development and maintenance of a wide range of physical and mental disorders. For example, Selye (1979) has suggested that faulty adaptation to stressors may result in cardiovascular, metabolic, digestive, inflammatory or kidney disease, sexual disturbance, infections, diabetes, cancer, rheumatic disease, arthritis, and allergies. He has outlined what he has called "the neuropsychiatric implications of stress", and suggested that in addition to psychosomatic disorders, stress might play an important role in the etiology of (1) neuroses, (2) autism and schizophrenia, (3) mania and depression, (4) drug dependence, and (5) other neuro-psychiatric conditions (Parkinson's disease, retrograde amnesia, insomnia, multiple sclerosis, Huntington's disease, and other nervous disorders). While it is premature to conclude that a functional relationship exists between exposure to stressful stimuli and the many disorders attributed to it, there is almost universal agreement that exposure to biological stresses does lead to a triad of morphological changes first identified by Selye (1936), which he labelled the "general adaptation syndrome". These changes include (1) adrenocortical enlargement, (2) thymicolympathic atrophy, and (3) gastrointestinal ulceration. He concluded that these effects were a nonspecific response to virtually all noxious stimuli, and resulted from a general mobilization of the organism's physiological resources along the hypothalamo-pituitary-adrenal axis,
in an effort to defend against the noxious agent.

Mason's Alternate Explanation of the Stress Reaction

While acknowledging the fact that relatively consistent physiological changes are associated with exposure to almost all noxious biological stimuli (e.g., heat, cold, starvation, blood loss, toxins, etc.), several investigators have questioned Selye's explanation of the mechanism involved. Mason (1975a, 1975b), for example, has challenged Selye's version of the manner in which information is transported from the site of injury to the pituitary-adrenal system, thereby initiating the body's stress reaction. Selye (1970) has invoked the existence of a hormonal substance he has labelled the "first mediator of stress". According to his theory, the first mediator is released by injured tissue and carried through the bloodstream, signalling the occurrence of physical trauma, and resulting in a nonspecific stress reaction -- unrelated to the type of noxious agent initially causing the tissue damage. Mason (1975a) has pointed out that Selye's failure to identify experimentally such a first mediator constitutes a major weakness in his stress theory.

A second area of concern expressed by Mason (1975a, 1975b) is that Selye's theory appears to be incompatible with one of the main premises of homeostatic regulation -- that need determines response. According to this principle, originally described by Cannon (1929), adaptive responses are selectively organized to counteract the specific bodily changes that elicit them. The idea of a general adaptive syndrome, then, is inconsistent with fundamental homeostatic
mechanisms as they are understood by most physiologists because of its very lack of specificity.

In advancing an alternative explanation as to how a wide range of noxious stimuli can result in what appears to be the same physiological response, Mason (1975b) suggests that

the unrecognized first mediator in many of Selye's experiments simply may have been the psychological apparatus involved in emotional arousal which is commonly activated when animals are exposed to a 'noxious', unpleasant, novel, or arousing condition in the laboratory...The fact that such emotional arousal is, in turn, now known to be characteristically associated with hormonal changes may well provide the most plausible explanation at present for the high frequency of adrenal cortical response in laboratory situations involving 'noxious' stimuli or stressors. In other words, this distinction fundamentally changes the view from that of a hormonal response being elicited largely by a great diversity of stimuli to that of a hormonal response being elicited largely by a single response class, common to a great diversity of situations, namely the ubiquitous factors which elicit emotional arousal.

(p. 25).

Mason (1975b) supports this view by pointing out that when
precautions are taken to minimize confounds associated with arousal in the study of biologic stressors, the pituitary-adrenal cortical system is not stimulated in a non-specific fashion (Mason, 1974; Mason, Maher, Hartley, Mougey, Perlow and Jones, 1975).

In addition to removing the need for a concept such as the elusive "first mediator of stress", Mason's (1968) formulation also reconciles the existence of what appears to be a non-specific physiological reaction with established views of homeostasis. He suggests that increased levels of adrenal cortical or medullar hormones are clearly an adaptive response to a wide variety of stressors because they prepare the organism in terms of mobilizing energy resources for motoric behavior in preparation for corrective behavioral actions. Mason therefore believes that the stress reaction is specific to aiding behavioral action aimed at the reduction of threat to the organism while Selye maintains that the stress reaction is non-specific and occurs in response to physical injury independent of the nature of the injury or the body's need for corrective action.

This reformulation of stress theory provides a platform from which to view psychological stressors and is consistent with cognitive-behavioral theories in psychology. These theories argue that "cognitive appraisal of harm via cerebrally controlled processes is necessary to initiate the body's defensive adrenal cortical response" (Lazarus, 1977, p. 146). It also suggests that the stress reaction associated with biological stressors is similar, if not identical to, that observed as a result of exposure to psychologically aversive
stimuli.

Cognitive Theories of Stress

Unlike the approach taken by Selye (1936) which defines certain stimuli as stressors, cognitive theories of stress maintain that while many stimuli may be potential stressors, almost none are necessarily so, including physical traumas. Consistent with Mason's viewpoint, the distinction between stressor and non-stressor, even with regard to physical injury, is seen to lie in the psychological significance of the stimulus (Lazarus, 1977). To support this viewpoint, cognitive theorists point to data that suggest that unconsciousness eliminates activation of the pituitary adrenal cortical system following physiological stress (Symington, Currie, Curran and Davidson, 1955). Symington and his colleagues found, for example, that patients who remained unconscious after an injury that ultimately resulted in their death showed a normal adrenal cortical condition at autopsy, while patients who were conscious prior to death showed the now familiar adrenal cortical changes.

This initial cognitive process of evaluating the significance of a stimulus for one's well-being has been labelled by Lazarus (1966) as primary appraisal. Whether a stimulus will be defined as a threat, however, and the wide range of individual differences that exist in defining an object or situation as threatening, speak to the many factors that impact on the primary appraisal process. One of the major goals of cognitive psychologists in seeking clues to treating stress has been the identification of those factors
which lead some individuals to perceive threat where others do not.

One of these factors is believed to be what Frank (1973) has labelled the "assumptive world" of the person. This refers to the complex set of beliefs, values, and expectations held by each individual. To the extent that an individual's belief system is realistic and internally consistent, any assessment of the environment, including the potential threat of any stimulus, is likely to be realistic. To the extent that the belief system is "irrational", however, the individual's commerce with the environment is likely to be disturbed; threat may be seen when none, in fact, exists (cf. Ellis, 1962; Beck, 1976; Meichenbaum, 1977).

A second factor thought to be associated with the assessment of threat is the individual's belief in his or her ability to cope with a potentially threatening stimulus, and has been labelled secondary appraisal (Lazarus, 1966). Whereas primary appraisal is directed at the question "Am I okay or in trouble?", secondary appraisal asks, "what can I do about it?" (Folkman, Schaefer, and Lazarus, 1979). Bandura's (1977) theory of behavior change, based on the concept of self-efficacy, suggests that the appraisal of coping skills as well as the initiation and persistence of coping attempts are based on four sources of information. These sources include the person's past history of (a) dealing with threatening stimuli, (b) vicarious experience, (c) verbal persuasion, and (d) emotional arousal.

In summary, it would appear that Mason's (1968) reconceptualization of the stress concept provides the best basis for integrating
the data that is currently available. Consequently, many of the coping skills utilized in the current study were selected with the view that the treatment of stress is best approached by focusing on the issue of appraisal of threat.

**Coping Skills Training: Introduction and Rationale**

As our understanding of the causes and effects of the stress reaction has increased, considerable attention has been focused on developing methods designed to help individuals combat the negative subjective, physiological, and behavioral consequences often associated with exposure to stressors. Behaviorally oriented psychologists have investigated several such techniques which are typically referred to as coping skills. Training individuals in the use of these coping strategies is based on the premise that individuals throughout their lifetime will have to confront stressors and that the ultimate goal of therapy is to provide them with resources to cope independently with them. This approach to treatment differs from so-called mastery models on which more traditional therapies are based, in that the mastery concept does not anticipate that treated clients will experience future stress reactions that may impair performance (Barrios and Shigetomi, 1979).

In a comprehensive review of outcome studies involving various approaches to coping skills training, Barrios and Shigetomi (1979) have identified several trends in behavior therapy that they believe are responsible for both the high level of activity in coping skills research as well as the direction that this research has taken. The
first such trend is the desire to provide individuals with skills that are effective not only in reducing stress in the present context but that will allow a measure of self-control and generalizability to other stressful situations as well. Experience with behavioral techniques currently in use for treating a wide variety of anxiety-related problems (e.g. systematic desensitization) suggests that treatment effects typically do not generalize to non-targeted behaviors. They also tend to rely heavily upon the expertise of the therapist for such things as hierarchy construction, reducing the likelihood of independent efforts by the client to cope with new stressful situations as they arise.

Second, the new recognition of the potent influence of cognitive processes in mediating the perception of external stimuli has lead to a strong emphasis on developing models for changing the manner in which individuals process information. As has been mentioned, primary and secondary appraisal are viewed as critical elements in the etiology of stress and almost all coping strategies incorporate into their procedures methods for changing one or both types of appraisal.

Finally, justification for the time and effort expended in developing and assessing coping skills training programs is based on data suggesting that large numbers of people suffer some degree of deleterious effects as a consequence of confronting stressors. Barrios and Shigetomi offer the following epidemiological data. Twenty percent of school children (Eysenck and Rachman, 1965), and 25 percent of college students (Suinn, 1969) are test anxious, and a significant
number of adolescents and young adults report intense heterosexual anxiety (Borkovec, Stone, O'Brien and Kaloupek, 1974; Fishman and Nowas, 1973; Martinson and Zerface, 1970). There is also evidence to suggest that among the non-clinical population there is considerable and often debilitating anxiety related to public speaking (Paul, 1966), assertion (Gambrill and Richey, 1975) and mathematics (Richardson and Suinn, 1973). In addition, in a study of the epidemiology of common fears and phobias, Agras, Sylvester and Oliveau (1969) listed snakes, heights, storms, flying, dentists, illness, injury, death, enclosures, journeys alone, and being alone as common feared situations.

In discussing deleterious effects of stress, other authors have emphasized what they believe to be the functional relationship between stress and physical illness. Monat and Lazarus (1977), for example, have suggested that there are three primary ways in which stress might lead to physical illness. The first of these is by the disruption of tissue functioning associated with increased hormone production, creating alterations in bodily processes. For example, there is a clear link between psychologically relevant stimuli (unpredictability, conflict) and a variety of physical disorders, especially ulcers of the gastro-intestinal tract (Weiss, 1970, 1971a, 1971b, 1971c). In addition, while the mechanisms involved are not totally clear, there is considerable evidence that the semantic activity generated by the cognitive appraisal process itself (i.e. self-statement, or internal dialogue) can affect physiological activity (Barber, 1965; May and
Johnson, 1973; Schwartz, 1971; Sternbach, 1964), emotional arousal (Goldfried and Sobocinski, 1975; Rimm and Litvak, 1968) and mood states (Hale and Strickland, 1976; Velten, 1968). Further, Meichenbaum (1977) has suggested that reinterpreting the meaning of on-going physiological arousal may mediate a shift in autonomic functioning. He states, "The present theory postulates that it is not the physiological arousal per se that is debilitating, but rather what the client says to himself about that arousal that determines his essential reactions" (p. 208).

There are at least two other aspects of exposure to stressful stimuli however, that may result in somatic disorders. Neither is the direct result of exposure to a stressor but rather, the result of inadequate methods of coping with such exposure. The first of these is engaging in active methods of coping that are damaging to health. In attempting to cope with occupational demands, for example, meals and needed rest may be ignored, and tobacco and alcohol may be abused. While not directly related to changes in hormonal output, such a lifestyle could increase the risk of a variety of disorders (Friedman and Rosenman, 1974).

A second coping mechanism that might lead to increased risk for disease is the utilization of a passive rather than active approach to dealing with stress, and is associated with denial and avoidance. Individuals who find dental visits highly stressful, for example, may delay or totally avoid needed dental treatment. Such action could lead to gum disease, tooth loss, or in extreme cases, failure to detect
oral cancer (Gale and Ayer, 1969).

Effective coping skills, then, as conceptualized by behavioral psychologists, are designed to serve several functions. It is suggested that they should directly affect both primary (assessment of threat) and secondary appraisal (assessment of coping resources). In doing so, physiological arousal should be reduced, subjective distress minimized, and behavioral disruptions eliminated. The skills learned should be generalizable to other stressors and should act to prevent or remediate future stress. These coping strategies should be under the control of the individual so as to minimize continued dependence on the therapist, and finally, they should replace current coping strategies which are counter-productive or even damaging to the individual's health. The following section will review some of the coping strategies that have been developed to help individuals more effectively cope with stress.

Coping Skills Training: Treatment Strategies

The basic goal of any form of coping skills training is to help an individual who is confronting a stressor to minimize the negative behavioral, physiological and subjective effects previously associated with its presentation. Several treatment strategies have been developed in recent years which are designed to accomplish this goal. While there are differences with regard to the theoretical rationale behind their development and the interpretation of the active ingredients responsible for the effects produced, all of these programs assume the techniques to be superior to traditional mastery-based procedures
with respect to generalization and prevention because they include coping skills which can theoretically be used to deal with problems other than those for which they were initially learned (Barrios and Shigetomi, 1979).

Four separate coping skills training programs have been identified by Barrios and Shigetomi (1979), although the breakdown is somewhat arbitrary, and there is considerable overlap in the specific skills they teach. These treatment strategies are: 1) anxiety management training (Suinn and Richardson, 1971), 2) applied relaxation (Chang-Liang and Denny, 1976; Deffenbacher and Snyder, 1976; Goldfried and Trier, 1974; Sherman and Plummer, 1973; Zeisset, 1978), 3) cue-controlled relaxation (Goldfried, 1971), and 4) self-statement modification (Meichenbaum and Cameron, 1974), which includes stress inoculation (Meichenbaum and Cameron, Note 1) and rational restructuring (Goldfried, 1977). These programs can be conceptualized as "treatment packages", each consisting of two or more separate coping techniques. These individual techniques include progressive muscle relaxation, educational instruction, cognitive restructuring, and imagery manipulation. Below is a description of each technique and an indication of which are included in the various coping skills training programs.

1. Progressive muscle relaxation - some form of instructed muscle relaxation is included in each of the four coping skills training programs. Most often a tension-release method is taught (Jacobsen, 1938), although several treatments utilize breathing
exercises and repetition of a single word to induce a relaxed state (e.g. Benson, 1975). Studies of the physiological effects of deep muscle relaxation have shown it to produce complex changes in autonomic arousal (Davidson and Schwartz, 1976). The therapeutic application of progressive muscle relaxation has been of special interest to the area of behavioral medicine, with such disorders as hypertension (Jacob, Karmer, and Agras, 1977), tension headache (Cox, Freundlich, and Meyer, 1975), and insomnia (Borkovec, 1979). Comparisons of biofeedback and progressive relaxation have shown the two treatments to be comparable over a wide range of disorders (Miller, Murphy, and Miller, 1978; Schwartz, 1978).

2. Educational instruction - education instruction is also part of all four coping skills programs. Most often it consists of providing a theoretical rationale to the patient for the subsequent presentation of what are assumed to be the more active techniques. The role of education in coping skills training packages has been neglected in favor of studying the efficacy of these "active components". Whether an educational component is necessary to the efficacy of the other coping techniques is unknown at this time. The role of the educational component will be discussed in detail below when the rationale for the current study is presented.

3. Cognitive restructuring - of the four coping skills training programs described by Barrios and Shigetomi (1979), only those categorized under the rubric of self-statement modification (rational restructuring and stress inoculation) attempt to directly modify
cognitive processes. Most often efforts are made to alter both primary and secondary appraisal of stress, although attempts at changing the perception of threat have been given the greatest emphasis. These have centered around direct attempts at manipulating belief systems and the internal dialogues associated with them. Whether the target of such change is a set of central irrational beliefs (Ellis, 1962), or idiosyncratic thought patterns (Meichenbaum, 1977), all approaches to cognitive restructuring include (1) presenting the rationale that self-statements or verbalizations mediate anxiety, (2) assisting clients to become aware of their self-statements in anxiety-arousing situations, and (3) teaching clients to replace these statements with incompatible positive self-statements through rehearsal with anxiety-arousing stimuli (Meichenbaum and Cameron, 1974). In addition to efforts at changing the perception of threat via restructuring of irrational or idiosyncratic cognitions, other cognitive strategies teach individuals to focus attention on objects in the physical environment in an attempt to exclude noxious or painful stimulation (Kanfer and Goldfoot, 1966; Kanfer and Seider, 1973). In addition, a technique called somatization - the focusing of attention on bodily sensations to the exclusion of other sensations - has also been utilized, primarily in pain research (e.g. Bobey and Davidson, 1970; Neufeld and Davidson, 1971). Outcome studies designed to assess the efficacy of these cognitive restructuring strategies as treatment modalities have shown promise in a number of areas including the amelioration of pain (Levendusky and
Pankrantz, 1975), the treatment of depression (Rush, Beck, Kovacs and Hollon, 1977; Rush, Khatami and Beck, 1975), stuttering (Moleski and Tosi, 1976), anger (Novaco, 1976), and stress (Sanchez-Craig, 1976). There are, however, many questions yet to be answered regarding the mechanism alleged to be responsible for therapeutic changes associated with cognitive restructuring. There is still no conclusive evidence, for example, that a functional relationship exists between changes in self-statements and improved functioning. Such a demonstration would require a methodology capable of assessing cognitions. Initial efforts are currently underway at developing and validating techniques for doing so (e.g. self-statements, Kendall and Korgeski, 1979).

4. Imagery manipulation - some form of imagery manipulation is used in each of the coping skills training programs with the exception of cue-controlled relaxation. Most of these take the form of vivid visualization of scenes in imagery which induce feelings of anxiety, but visualization of imagined situations of relaxation or competency are also used (Suinn and Richardson, 1971). Other imagined techniques as described by Meichenbaum (1977, p. 172) include: (1) imaginative inattention - ignoring the pain by engaging in "goal directed fantasy" which would be incompatible with the experience of pain (e.g. Chaves and Barber, 1974; Horan and Dellinger, 1974); (2) imaginative transformation of pain - acknowledgement of the noxious sensations, but transforming or interpreting these sensations as something other than pain, or minimizing the sensations as trivial or unreal (e.g. Barber and Hahn, 1962; Blitz and Dinnerstein, 1971; Spanos, Horton
and Chaves, 1975); and (3) imaginal transformation of context - the acknowledgement of the painful sensations but transforming the context in which these sensations are received (e.g. Blitz and Dinnerstein, 1968; Wolff and Horland, 1967).

How effective are combinations of these coping techniques in reducing the negative effects of stress? Even after an exhaustive review of the coping skills literature, Barrios and Shigetomi (1979) could only state,

Although the review reveals that coping skills training programs are more effective than no treatment, mixed results were obtained with regard to their superiority to traditional behavioral treatments and attention-placebo control conditions. In addition, judgement must be suspended with respect to generalized effects produced by coping skills training. The differences between studies finding generalized effects and those not finding them are unclear. Future research in these areas is clearly warranted (p. 516).

Some of the most successful treatment packages surveyed by Barrios and Shigetomi were those categorized as self-statement modification procedures. In addition to being superior to no-treatment controls, these treatment strategies were often superior to placebo control conditions. The specific treatment program
thought by many to offer the most promise for improvement of stress-related behaviors as well as for prevention and generalization, is stress inoculation training (Meichenbaum, 1974). This treatment package has received a great deal of exposure in publications and often is the only cognitive restructuring procedure presented in detail by authors purporting to survey behavioral treatment strategies (e.g. Davidson, 1976). There has been a surprisingly small amount of research conducted on the therapeutic efficacy of stress inoculation training, however. Of the 22 self-statement modification studies reviewed by Barrios and Shigetomi (1979), for example, only two dealt with the full stress inoculation procedure. The following section describes the stress inoculation training procedure in detail and presents the results of a few studies designed to assess its potential for stress reduction.

**Stress Inoculation Training: Description**

Stress inoculation training (Meichenbaum, 1974) was developed in response to new understanding about the obvious complexity of the coping process and because of a desire to increase treatment generalization; it involves three phases: (1) education about the nature of stress, (2) rehearsal of coping skills, and (3) application of coping skills in a practice format.

The education phase was designed to provide the individual with a conceptual framework for understanding the nature of the stress reaction. Meichenbaum (1977) suggests that the particular conceptualization utilized (e.g. Schachter's theory of emotion, 1966; or
Melzack and Wall's theory of pain, 1965) is less crucial than its face validity or air of plausibility for the individual involved in treatment. This reconceptualization or translation of the meaning of the stress reaction, from the individual's idiosyncratic appraisal to a viewpoint and language system shared in common with the therapist, are believed to provide a sense of control (efficacy) which many suggest is a prerequisite for behavior change (e.g. Bandura, 1977).

The second phase of stress inoculation training was designed to provide the individual with various coping skills. Several coping techniques are introduced at this stage in the program. Individuals are instructed to choose from among the several techniques presented, those which they believe will be of most use to them when confronting a stressor. This cafeteria-style approach to the selection of coping strategies is based on the finding that when subjects have control over which coping strategy to utilize (as opposed to being "assigned" one), the efficacy of coping attempts increases (Kanfer and Seider, 1973). Meichenbaum's selection of coping strategies taught during this rehearsal phase was based on empirical findings as to their effectiveness (e.g. relaxation training) or potential utility (e.g. cognitive restructuring, imagery) for the management of stress.

Relaxation training, for example, is described as a method for reducing physiological arousal and as a positive behavior on which to focus. The cognitive coping strategies involve the identification of negative, anxiety-producing, and self-defeating self-statements, which are emitted during confrontation with the stressor. The occurrence
of visceral arousal is then identified as a cue for producing incompatible coping statements. These self-statements encourage the individual to (1) assess the reality of the situation; (2) control negative thoughts and images; (3) acknowledge, use, and re-label the arousal that is experienced; (4) prepare to confront the stressor; and (5) cope with the intense fear that might be experienced and provide self-reinforcement for having tried to more effectively manage the stress (Meichenbaum, 1977).

The third phase of the stress inoculation program, application training, is designed to give the individual the opportunity to test out and practice his/her coping skills by actually employing them under stressful conditions. Such a procedure primarily should affect secondary appraisal of stress by providing the individual with information about his/her ability to cope with stressful stimuli.

**Stress Inoculation Training: Treatment Outcome Research**

The initial stress inoculation training study was conducted using multiphobic subjects (Meichenbaum and Cameron, Note 1). These individuals identified themselves as avoiding both harmless snakes and rats and indicated that their fear had a restrictive influence on their ability to participate in certain activities (e.g. camping, picnicking, etc.). Prior to treatment, all subjects underwent a behavioral assessment which involved a graduated set of approaches to the phobic objects, and they completed self-report anxiety scales. They were then seen individually for six one-hour sessions over a four week period. During the education process, the individuals' anxiety
reactions were explained in terms of a Schachterian model of emotional arousal, i.e., fear involves two major elements, (a) heightened physiological arousal, and (b) a set of anxiety-engendering avoidant thoughts (Schachter, 1966). The rehearsal phase involved teaching both, direct action (e.g. collecting information, physical relaxation) and cognitive coping skills (e.g. identification of negative self-statements, rehearsal of coping self-statements, and relabelling the arousal). The application phase permitted the rehearsal and implementation of the coping skills in the presence of experimentally induced anxiety generated through the use of unpredictable electric shock. The effectiveness of the stress inoculation package was assessed relative to (a) a group which received systematic desensitization treatment, (b) a self-instructional rehearsal group, which received the educational and rehearsal phase but not the application training, and (c) a waiting list control group. In order to assess the degree of treatment generalization that resulted from desensitization as compared to stress inoculation, half of the treated subjects dealt only with their fear of rats during treatment sessions, while the others focused efforts only on their fear of snakes. The results suggested that stress inoculation training was more effective than desensitization in reducing avoidance behavior and in effecting treatment generalization. The desensitization treatment proved effective in reducing fear only to the desensitized objects.

Subsequent outcome studies have had less clear-cut results. For example, Hussain and Lawrence (1978) in a study using test anxious
college students, compared a test specific and a generalized stress inoculation training program with two control conditions, a discussion control, and a waiting list control. The test specific groups received coping statements with test referents while the generalized group was trained with non-situation specific coping statements. The specific stress inoculation training was found to be superior to both control conditions while the general program was superior to only the no treatment control condition. This was the first study to raise questions about the concept of "inoculating" subjects against stress. The failure of the general stress inoculation training to provide any greater benefit than the attention control condition is contrary to Meichenbaum's suggestion that a general training program can generalize to help individuals cope with other, unrelated stressors.

One of the more popular applications of stress inoculation training has been in pain (Hackett and Horan, 1980; Hackett, Horan, Buchanan and Zumoff, 1979; Horan, Hackett, Buchanan, Stone and Demchik-Stone, 1977; Klepac, Hauge, Dowling, and McDonald, 1981; Turk, 1975). The initial study in this area was done by Turk (Note 2) using ischemic pain with college student volunteers. After one hour of stress inoculation training, subjects were able to tolerate such pain for a period of 32 minutes, compared to 17 minutes at pretreatment. These subjects also subjectively perceived the arm pressure as less painful during post treatment assessment. An attention-placebo group, which received the educational phase of treatment, demonstrated minimal change in tolerance from the pre- to post-assessment (18 to 19 minutes).
Other studies have attempted to isolate the effective components of the training package when used with pain and to assess generalization of training to an untrained, laboratory-induced pain. Horan et al. (1977) conducted a component analysis in which efforts were focused on increasing tolerance to pain which was generated using the cold pressor task (Hines and Brown, 1932). A pressure algometer task (Merskey and Spear, 1964) served as a generalization test of the treatment conditions. Only the coping skills component was found to increase pain tolerance above the no-treatment control and the non-specific treatment condition which included the educational component. The exposure component which consisted of 6 repetitions of the cold pressor task did nothing to improve pain tolerance at post assessment. None of the three components yielded improved performance on the generalization (pressure algometer) task.

In a follow-up study, Hackett et al. (1979) assessed the effects of changing tactics associated with the exposure component as well as the inclusion of specific attempts to program generalization. Again, the cold pressor task served as a direct test of the treatment conditions and the pressure algometer task was used to assess generalization. Three treatment groups were utilized, all of which received identical stress education and coping skills training. With regard to the exposure component, one group received zero trials, one group one trial, and one group six trials on the cold pressor task during which they were instructed to practice their coping skills. Results indicated that the one exposure condition proved marginally better on
the direct measure than either the zero or six exposure conditions, which did not differ from each other. The attempt to enhance generalization involved a modeling procedure in which the experimenters demonstrated the use of coping skills in personally relevant discomforting situations identified by the subjects. This generalization training resulted in improved pressure algometer tolerance for only the one exposure condition.

A third study by this group (Hackett and Horan, 1980) also using the cold pressor task, found improved pain tolerance for stress inoculation subjects when compared to no treatment controls (44 percent vs. 11 percent reached a five minute endurance ceiling). However 33 percent of the subjects receiving the education and exposure component (with no coping skills training), also reached the five minute ceiling. Generalization was not assessed.

The most recent assessment of the effects of stress inoculation on tolerance of laboratory induced pain was conducted by Klepac, et al. (1981) using college students who reported they were fearful of the dentist. Subjects receiving all components of the stress inoculation procedure showed greater pain tolerance to the targeted stressor (arm shock) than did groups receiving combinations of only two components. Contrary to the findings of Horan et al. (1977) however, multiple exposure to the stressor had a significant impact on pain tolerance when combined with relaxation training. Attempts by Kelpac et al. (1981) to generalize improved arm shock tolerance to tooth shock in these dentally anxious subjects was not successful,
....despite the fact that increases in tolerance of tooth shock were described to subjects as the goal of treatment, which was repeated and discussed with subjects at several points. Neither this verbal encouraging of transfer, nor the selection of a generalization test relevant to our dentally fearful subjects improved upon Horan et al. (1977) finding of non-generalization (p. 8).

Other investigators have attempted to assess the effectiveness of stress inoculation training in reducing anger and other stressful responses to provoking situations. Novaco (1974, 1977a, 1977b) first attempted to use the stress inoculation concept for anger control. In his initial study, Novaco (1974) found that stress inoculation training was more effective than relaxation alone, or self-instruction alone in reducing anger as assessed by laboratory-based provocations in a group of patients with anger control problems. He has followed his initial work with a case study in which a hospitalized patient with a severe problem controlling his anger was successfully treated with a stress inoculation program in 15 sessions (Novaco, 1977a), and by a preventative treatment program for law enforcement officers designed to help them more effectively manage anger-provoking situations (Novaco, 1977b). In each of these applications, stress inoculation was reported to be highly successful in reducing anger reactions. Other investigators using stress inoculation in anger management have not reported such clear-cut results, however.
Sarason, Johnson, Berberich and Siegal (1979) provided a stress inoculation training program to police academy trainees which focused on developing skills for coping with anxiety and anger. Subjects receiving the stress inoculation training program were rated by academy personnel as exhibiting superior performance in several simulated police activities when compared to an attention-control group. Self-report measures, however, indicated that treatment subjects had significantly more difficulty controlling their feelings of anger, and relative to controls, also displayed a significantly higher level of test anxiety during the simulated police activities.

**Rationale for the Present Study**

In general, it would appear that evidence from previous studies which have focused on the stress inoculation treatment package support its efficacy as a stress management procedure. There are several shortcomings in this literature, however, which tend to limit the generality of this conclusion. The first of these is the use of analogue subjects. Despite the problems associated with analogue research (Bernstein and Paul, 1971), the stress inoculation literature to date is characterized by an almost exclusive reliance on such methodology, leaving doubts about the external validity of the obtained results. With the possible exception of Meichenbaum and Cameron's original investigation involving subjects who displayed phobic avoidance of snakes and rats (1972), there have been no studies in the stress inoculation literature that utilized stressors which were personally or clinically relevant to the subject population.
being studied. Each investigation which purported to assess the effects of stress inoculation training on pain tolerance, for example, used college student subjects and laboratory-induced pain (Hackett and Horan, 1980; Hackett, et al., 1979; Horan, et al., 1977; Klepac, et al., 1981). Similarly, the effectiveness of stress inoculation training for the treatment of anxiety was assessed utilizing test anxious college students as the focus of intervention (Hussian and Lawrence, 1978).

Perhaps the most encouraging outcome studies with respect to external validity have come from the use of the stress inoculation concept for controlling anger. Novaco treated individuals who evidenced difficulties associated with poor anger control in both a group research (1974) and a case study (1977a) design. He obtained positive results in both behavior and self-report assessment channels in each case. It is not at all clear, however, that a treatment that is effective in anger control or test anxiety, both of which have strong social-evaluative components, will be equally effective in treating stress associated with personal threat, harm, or pain. Indeed, there is reason to believe that the cognitive processes involved, and possibly the etiology are different for the two problem areas (Ellis, 1979). For example, fear of dental procedures could conceivably be based in classical conditioning, whereas anger most probably is not. This leaves the results obtained by Meichenbaum and Cameron (Note 1), working with animal phobics, as the only evidence for the utility of stress inoculation training for the management of subjective anxiety.
and avoidance behaviors in a clinical population.

It would appear, then, that despite the publication of several studies designed to assess the efficacy of the stress inoculation package, there remain unanswered questions regarding the confidence with which these results can generalize to clinical populations. Consequently, the primary purpose of the present study was to determine whether stress inoculation training was associated with a reduction in subjective, behavioral, and physiological indices of stress in a clinical population, thus replicating and extending the findings of Meichenbaum and Cameron (Note 1).

In addition, in an effort to overcome the problems associated with the utilization of an analogue population, the sample of subjects utilized in the present study consisted of individuals who reported high levels of stress associated with exposure to stimuli surrounding dental treatment. Several authors have commented on the suitability of such a population for the study of clinical levels of stress. Lazarus (1966b), for example, has stated,

Not only does the dental context provide an excellent area in which to study the principles of stress, but, conversely, the analysis of stress as a general phenomenon also offers great possibilities of applying principles of stress production and reduction to dental practice (p. 1620).

One of the considerations in selecting this population related to the sheer numbers of individuals who exhibit stress related behaviors
in a dental context. An effective and cost-efficient method for treating this population would result in several potential benefits for patients and dentists. Fear of dentistry, whether it is manifested by a phobic avoidance of the dental situation, or through the experience of other stress-related behaviors (subjective anxiety, uncomfortable levels of physiological arousal) is a significant problem for approximately 10 million Americans (American Dental Association, 1978). The consequences of such behavior, unlike much other fear-motivated responding, may be severe, and includes such problems as poor treatment results related to difficulty in performing dental procedures, lowered energy levels from inability to chew needed foods, and failure to detect oral cancer (Gale and Ayer, 1969). In addition, Hollinshead (1961) has discussed the possible negative psychological effects of unsightly teeth. From the dentist's perspective, fearful patients represent clinical, organizational, and even potential health problems for dental personnel. Inability to provide optimal treatment because of patient anxiety is a common problem with this patient group. The only behavioral index found to differentiate fearful from non-fearful patients to date, has been number of broken and cancelled appointments (Kleinknecht and Bernstein, 1978), which often leads to wasted professional time. Finally, long-term exposure to the commonly used anti-anxiety agent, nitrous oxide \((N_2O)\), may constitute an occupational health hazard.

Dental fear, as with most other fears, can be conceptualized as being a continuum, ranging from little or no fear aroused by the dental
situation, to total avoidance. Dental fear has other, unique characteristics however, that are not shared by the majority of fears typically treated by psychologists, and which make the fearful dental patient an ideal subject on which to test the effectiveness of any stress management procedure. Unlike most other fears, dental fear often is associated with a history of a noxious stimulus, paired with a variety of neutral stimuli, raising the possibility of a classically conditioned etiology. An additional characteristic is that the conditioned stimulus-unconditioned stimulus pairing is likely to continue after the termination of treatment. Individuals typically cannot avoid the feared situation because of the increased likelihood of a dental emergency resulting from the avoidance of treatment. Also, unlike many phobic situations, dental avoiders may not wish to continue to avoid dental treatment because of a concern for maintaining some level of proper dental care and pride in personal appearance. Finally, it may not be realistic to expect that subjective and physiological arousal to stimuli associated with the dental operatory will disappear after treatment. A more realistic objective might be to obtain behavioral indices of stress which are at levels associated with individuals who report no difficulty seeking and obtaining needed dental treatment.

In summary, characteristics of dental stimuli would appear to make the high fear dental population a reasonable choice for assessing the effectiveness of the stress inoculation model. The population is large, the problems associated with stress-related behaviors are
such that delay or avoidance of treatment are potentially severe, and almost all individuals must ultimately seek dental treatment.

A second problem with previous stress inoculation research relates to what appear to be conflicting conclusions regarding the effective components of the intervention procedure. These may be the result of a lack of standardization of individual components. With regard to the exposure component of the stress inoculation package, for example, Horan, et al. (1977) found the exposure component to be ineffective in improving pain tolerance while Hackett, et al. (1979) concluded that a single exposure produced better results than did no exposure or six exposures to the stressor. Klepac, et al. (1981) reported that multiple exposures were effective in increasing pain tolerance, but only when combined with a relaxation procedure.

There is similar confusion with respect to conclusions regarding the contribution of the educational component of the treatment package to outcome. Each research effort designed to determine which parts of the program constitute the "active ingredients" of treatment (Hackett, et al., 1979; Horan, et al., 1977; Klepac, et al., 1981) have yielded essentially the same conclusion—that the educational component was "necessary but insufficient for pain-coping performance" (Horan, et al., 1979, p. 219). After reviewing methodological problems with this type of effort however, Jaremko (1979) concluded, "Therefore it appears that a stringent test of the contribution of the educational rationale has yet to be undertaken" (p. 37). In addition, the results of several studies have suggested that a heavy emphasis on coping skills training
may not be necessary to effect behavioral change if information about the stressor is presented clearly (e.g., Kendall, Williams, Pechacek, Graham, Shisslak, and Herzoff, 1979). Because of the lack of correspondence between the results of past research relating to the effectiveness of stress education in producing behavior change, a stress education condition was included in the present study. The procedure used, and the material presented, were based on a standardized presentation of the education component as described by Jaremko (1979). The procedure is based on the Schachterian (Schachter, 1966) model of arousal in which stress is seen as a cycle of physical arousal, autonomic appraisal, and negative self-statements. It should be noted that this model for presenting education about stress bears a strong resemblance to a cognitive restructuring strategy developed by Ellis for the treatment of clinical phobias (Ellis, 1979). While admitting that traditional methods of cognitive restructuring which focus on the feared object are often ineffective with phobias, he has suggested that success may be enhanced by focusing on beliefs about the meaning of the physiological arousal associated with exposure to the stressor. According to this hypothesis, clinical phobics differ from analogue subjects in that they have a higher level of physiological arousal in anxiety-engendering situations (Lader, 1967). One of the variables responsible for maintaining fear in a clinical population is their anxiety with regard to the meaning of their physical reaction when confronted with a stressor (rapid heart rate, shortness of breath, etc.). Ellis (1979) has labelled this phenomenon
"discomfort anxiety". He suggests that in such cases cognitive restructuring would be aimed at helping individuals understand the nature of their physiological reaction rather than catastrophizing about its occurrence.

It would appear, then, that the educational component suggested by Jaremko (1979), and utilized in the current study, can be conceptualized as having a significant restructuring aspect to it, focused on what Ellis has labelled discomfort anxiety. A secondary purpose of the present study was to determine whether the educational component by itself was capable of effecting changes in stress-related behaviors, and how such changes compared to those obtained using the full stress inoculation package.

A third problem with previous attempts to assess treatment effects of stress inoculation training is the restricted numbers and types of dependent variables used to assess outcome. This failure to consider the multidimensional nature of the stress reaction can yield problems associated with equivocal results such as those obtained by Sarason, et al. (1979) with police trainees. The assessment of physiological data may have helped to clarify their results. While all stress inoculation studies have utilized self-report and behavioral indices of stress as measures of treatment outcome, only Horan, et al. (1977) attempted to assess treatment effects on a physiological variable (heart rate). Unfortunately, as the authors pointed out, heart rate was a poor choice; the imagery involved in several coping strategies can be expected to produce heart rate acceleration (Hanlay and Euse,
1976), making the measures useless as an index of stress. Considering the long history of research into the physiological effects of stress, especially those associated with the pituitary-adrenal system, it is surprising that no attempt has been made to assess the effects of stress inoculation training in this area. Previous research on the physiology of the stress reaction strongly suggests that the level of pituitary-adrenal activation of treated vs. untreated subjects could serve as an important index of stress reducing properties of any intervention technique. To date, however, there has not been a single documented report of the successful manipulation of adrenocortical functioning by means of a psychologically-based intervention strategy. The third purpose of the present study, then, was to validate plasma cortisol levels as an index of stress and to then utilize this measure in the assessment of treatment outcome.

A final problem with previous research in the area relates to the emphasis placed on assessing the effectiveness of stress inoculation training in generalizing from a treated to an untreated stressor prior to the publication of a clear demonstration of the program's effectiveness with a clinical population. For example, Hackett, et al. (1977) reported that, while no treatment effect for stress inoculation was found for the primary stressor, generalization of treatment was obtained for the secondary stressor. Attempts at replicating this "generalization" effect have not been successful (Klepac, et al., 1981). The present study, therefore, was focused primarily on assessing treatment effects on a trained, primary stressor. Generalization effects were
assessed more indirectly than has been done in previous studies and utilized measures of trait anxiety (STAI-Trait, Spielberger, Gorsuch and Lushene, 1970) and a fear survey schedule (Fear Survey Schedule III, Wolpe and Lang, 1964) in an effort to determine whether "inoculation" against other, untrained stressors had occurred.
Method

Design

The present study utilized a four group repeated measures design (Huck and McLean, 1975) which included two treatment groups (1) stress inoculation and (2) stress education and two control groups (3) high fear no treatment and (4) low fear validation. Statistical analyses of data were performed utilizing linear regression procedures including analysis of variance and covariance as well as several correlational analyses. In cases where there were directional hypotheses a one-tailed test of statistical significance was utilized (Ley, 1979).

Therapists

Two male therapists of approximately the same age separately conducted each session of the two experimental treatment conditions. The experimenter therapist conducted all five stress inoculation sessions while the other therapist conducted the five stress education sessions. Both therapists were experienced in conducting stress management programs in a group context. Prior to each session, both therapists met together to assure that the materials and strategy for the upcoming session were clear.

Subjects

The four experimental groups were initially composed of 37 adult volunteers (14 males and 23 females) who ranged in age from 18 to 57 years. The data for 5 subjects were not used in analyses of treatment effects because 3 subjects participated in only the initial assessment and two subjects in the stress education group did not participate in the post-treatment assessment session.
In addition, the cortisol data for two subjects was excluded from the cortisol analysis due to the subjects' use of medication and one subject's recent strenuous physical exertion. Two of these groups consisted of students enrolled in an introductory psychology class who received course credit for their participation in the study. They were assigned to either a low fear validation group, or, after indicating they did not desire treatment, to a high fear no treatment control group. Assignment to either group was made on the basis of scores on the Dental Anxiety Scale (Corah, 1969) obtained during a mass screening session. All high fear subjects scored at least one standard deviation above the mean reported by Corah in his validation sample of 1232 subjects ($X=8$, $SD=3$). With one exception, the low fear subjects all scored at least one standard deviation below that mean.

Subjects in the two treatment groups were either referred by their personal dentist, asked for treatment after being identified as high fear subjects in the mass screening of students, or had responded to a local media campaign designed to recruit individuals who considered themselves fearful of dental procedures. Assignment to either the stress inoculation condition or the stress education condition was done randomly, with the provision that each sex be equally divided between the two groups.

Table 1 provides descriptive characteristics of each group with regard to sex, age and Dental Anxiety Scale scores.
Materials

The assessment of the stress reaction associated with dental treatment is critical with regard to analyzing the effectiveness of any procedure designed to reduce or eliminate it. Research has repeatedly shown that stress is a complex response which can cause changes in subjective, physiological, and motoric channels of behavior. Because it is often impossible to predict a change in one channel based on observations of another, a multi-channel of assessment approach is necessary (Bernstein and Paul, 1971; Borkovec, Weerts, and Bernstein, 1977; Lang, 1968).

In the present study, individual assessment was conducted within the self-report, motoric and physiological channels of behavior, during periods immediately prior to, and after the treatment intervention. It should be noted that no attempt was made to define the term "stress". The long history of the use of the term in so many different contexts has lead to a situation in which it carries meaning only in the broadest sense. For that reason this paper will talk in terms of "stress-related behaviors". The efforts at treating stress will be focused on changing these behaviors. The dependent measure designed to assess behavioral change are described below.
Table 1:
Pre-treatment Descriptive Characteristics of Subjects Used for Validation of Measures.

<table>
<thead>
<tr>
<th>Experimental Group</th>
<th>Males</th>
<th>Females</th>
<th>Age</th>
<th>Dental Anxiety Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( \bar{X} )</td>
</tr>
<tr>
<td>Low fear validation</td>
<td>8</td>
<td>4</td>
<td>21.1</td>
<td>8.19</td>
</tr>
<tr>
<td>High fear no treatment</td>
<td>1</td>
<td>6</td>
<td>20.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Stress education</td>
<td>2</td>
<td>7</td>
<td>29.56</td>
<td>10.6</td>
</tr>
<tr>
<td>Stress inoculation</td>
<td>3</td>
<td>6</td>
<td>26.33</td>
<td>6.46</td>
</tr>
</tbody>
</table>
Self-Report Measures

1. Speilberger's State-Trait Anxiety Inventory (STAI; Speilberger, Gorsuch, and Lushene, 1970).

The STAI is designed to measure subjective anxiety and consists of two parts; (1) a state anxiety subtest designed to assess reactive, situational anxiety and (2) a trait anxiety subtest that purports to measure a hypothetical personality characteristic, and theoretically more stable condition, of "anxiety proneness". The theory behind the development of the scale would suggest that high trait-anxious subjects experience state anxiety in response to a wider array of stimulus conditions than subjects low in trait anxiety.

The STAI consists of 40 items; state and trait anxiety are assessed by 20 items each. Items are on a 4-point Likert-type scale and are presented in counter-balanced order relative to anxiety. Scores for each subtest can range from 20 to 80 with higher scores associated with greater anxiety. Test-retest reliabilities for the trait-anxiety subtest for male and female college undergraduates over a six-month period are .73 and .77 respectively. Predictably, test-retest reliabilities of the state subtest are low, but the internal consistency as measured by KR-20 ranges from .83 to .92.

The STAI was selected for use in the current study because it has impressive reliability and validity data associated with its use, it is administered easily, and has been used in a variety of dental studies (Auerback, Kendall, Cuttler and Levitt, 1976; Lamb and
Plant, 1972; McAmmond, Davidson and Kovitz, 1971; Weisenberg, Kriendler and Schacht, 1974). Lamb and Plant (1972) found that women had higher STAI-state scores than men at each of three phases of dental treatment. In addition, the mean STAI-state scores for all patients increased significantly from the wait to the chair phase and decreased significantly from the chair to the after phase. McAmmond, et al. (1971) using relaxation and hypnosis treatment groups and a no treatment control, found that the treatments had no effect on STAI-state scores when the scale was administered after subjects had been given an intra-oral injection. Weisenberg, et al. (1974) found that the STAI-state correlated significantly with the Dental Anxiety Scale developed by Corah (1969; r=.48, p < .001, df=71). Auerbach, et al. (1976) found that the Dental Anxiety Scale, administered an average of 24 days prior to dental surgery, predicted differential elevations of state anxiety in the dental situation. They also reported that level of state anxiety just prior to dental surgery was significantly correlated with previous incidence of traumatic medical and dental experience, and was also inversely related to the amount of time since the subject's last visit to the dentist.

2. Internal-External Locus of Control Scale (IE Scale; Rotter, 1966). The IE Scale contains 29 items (including six filler items) in a forced-choice format. The range of possible scores is from 0 to 23. It is designed to assess individual generalized expectancies for internal versus external control of reinforcement. Subjects classified as internals (for purposes of the present study, those individuals with
a score of 10 or below) are described as holding a generalized expectancy that one can affect the environment through one's own behavior. They are likely to: a) be more alert to aspects of the environment which may provide information useful in guiding future behavior; b) take steps to change the environment; c) place greater value on skill and be more concerned with their own ability, and d) be resistive to subtle attempts at influence (Rotter, 1966). The IE Scale is well-researched. Internal consistency estimates are stable, with Kuder-Richardson reliabilities averaging about .70 across several samples. One month test-retest reliability averages .75 across two different populations and correlations of close to zero have been obtained with intellectual measures.

3. Profile of Mood States (POMS; McNair, Lorr, and Droppleman, 1977). The POMS consists of 65 five point adjective rating scales which have been factored into six mood scores: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment. The purpose of the POMS is to identify and assess "transient fluctuating affective states". It has often been used in previous research to evaluate the effects of psychotherapy and medication on mood states. For purposes of the current study, only the tension-anxiety (TA) factor was utilized. A single TA score was derived from the sum of ratings nine adjectives and could range from 0 to 36, with higher scores indicating greater tension-anxiety levels. Psychometric properties of the POMS have been reported. Kuder-Richardson values range from .84 to .95 in two samples of
psychiatric patients and the scales have considerable face validity. Several studies have been successful in establishing construct validity (e.g., Kochansky, 1973).

4. Dental Anxiety Scale (DAS; Corah, 1969). The DAS is a four item scale designed to assess the presence of anxiety associated with dental treatment. Each item has five possible responses ranging from one (a statement associated with little or no anxiety) to five (a statement associated with high levels of anxiety). Total scores can therefore range from 4 to 20. In one sample of 1232 college students, the mean score was 8.89 with a standard deviation of 2.99. The median and mode were both 8. Psychometric properties of the DAS as reported by Corah (1969) and based on the college student sample, were as follows: KR-20 stability coefficient was .86, test-retest reliability (3 month) was .82. Validity claims are based on the correlation between two dentists' ratings of patient anxiety and DAS scores (.41 and .42).

5. Fear Survey Schedule III (FSS III; Wolpe and Lange, 1964). The FSS III is a 72-item scale developed for clinical use. It includes "the most frequent neurotic anxiety stimuli that have been encountered in patients in the course of 15 years of practice of behavior therapy" (p. 27). Each item has been assigned by the authors to one of six subclasses: 1) animal; 2) social or interpersonal; 3) tissue damage, illness and death, and their associations; 4) noises; 5) other classical phobias; and 6) miscellaneous (e.g., strange places, falling, failure, etc.). Subjects are instructed to indicate how disturbing
each item is on a five point scale ranging from "Not at all" to "Very much". No validity or reliability data are reported by the authors.

6. Dental Fear Survey (DFS; Kleinknecht, Overcast, and Klepac, Note 4). The DFS is a 20-item Likert-type scale with scores for each item ranging from one (relaxed) to five (fearful). Factor analysis of these items yield three factors: 1) anticipation of dental treatment (items 1, 8-13, 20); 2) fear of pain (items 13-18); and physiological response to dental treatment (items 3-7 and 11). Item 20 was also utilized as a single rating because it is an overall fear rating of dental procedures. A test-retest reliability study of a similar 27 item scale yielded median correlation coefficients of .74 for items across 106 participants, and .73 for participants across all items. A KR-20 reliability coefficient computed by the present author using responses from 395 college age subjects was .955 using the 20-item version of the scale. There are no validity data reported for the scale, but its high face validity makes it reasonable to include it as part of the assessment battery. A copy of this scale is located in Appendix B.

7. Dental Self-Statement Inventory (DSSI; Bosmajian, Note 5) The DSSI is a twenty item inventory constructed in a manner similar to that employed by Kendall, et al. (1979). It was devised in pilot research conducted prior to the current study and contains 10 "positive" and 10 "negative" self-statements. The original list of self-statements was obtained from interviews with high and low fear dental patients who were asked to report their own thoughts prior to and during dental
treatment. The methodology used in constructing the instrument involved having 30 undergraduate psychology students inspect the original list of 36 statements and indicate next to each whether they believed thinking the statement to themselves during dental treatment would help or hinder their own coping behavior. From the items on which 100 percent agreement was obtained, 10 positive and 10 negative statements were randomly selected to comprise the inventory.

Instructions for the DSSI ask subjects to indicate on a five point scale (1=hardly ever to 5=very often) how frequently the self-statements characterized their thoughts during dental treatment. A separate score is obtained for positive and negative statements with higher scores on each dimension indicating a greater degree of positive or negative thinking prior to and during dental treatment. Scores for each dimension can range from 10 to 50. The scale's validity for discriminating high from low fear subjects was established using the sample of subjects in the present study. High fear subjects rated themselves as experiencing significantly more negative self-statements (F=7.12, df 3, 33, p < .0008) but a similar number of positive self-statements (F=.82) than low fear subjects. A copy of this scale is located in Appendix B.

8. Dental Self-Efficacy Scale (DSS; Bosmajian, Note 6). The DSS was designed to assess subjects' expectancy with regard to their ability to successfully execute the various behaviors required to successfully complete a dental visit. It involves asking subjects to: a) predict their ability to accomplish 10 behaviors related to
dental treatment which are ordered in level of difficulty (efficacy level), and b) indicate the degree of certitude they possess with respect to their prediction of their ability to accomplish each behavior (efficacy strength). Scores for efficacy level can range from 0 (can perform none of the behaviors), to 10 (can perform all of the behaviors). Scores for efficacy strength can range from 10 (virtually impossible) to 100 (almost certain). A copy of this scale is located in Appendix B.

**Behavioral Measures**

1. Behavioral Avoidance Test (BAT; Lang and Lazovik, 1963). The BAT consisted of nine behaviors, each one a close approximation of what would occur if actual dental procedures were going to be performed. It was designed to assess the degree to which there was behavioral avoidance of dental stimuli. The behaviors were arranged in a hierarchy from least anxiety-arousing (enter the operatory), to most anxiety arousing (allowing an intra-oral injection). Prior to beginning the procedure, subjects were informed that they were going to be asked to perform several behaviors. They were also told that they could terminate progress up the hierarchy of behaviors at any time by simply indicating that they did not wish to continue. Before each item on the behavioral hierarchy, a research assistant who was blind to the group assignment of the subjects, informed the subject of the upcoming step and asked if he/she could complete it. If the subject answered in the affirmative, he/she was given the opportunity to demonstrate the behavior. If the answer was negative, the BAT was
discontinued at that point. The BAT consisted of the following behaviors: 1) enter the operatory; 2) sit in the dental chair; 3) allow a dental bib to be put in place; 4) sit in the chair alone for a "few minutes"; 5) open mouth and allow dentist to look at teeth using dental mirror; 6) allow dentist to examine individual teeth with a dental probe; 7) allow the dentist to contact several teeth with a polishing burr attached to a dental drill; and 8) allow the dentist to perform an intra-oral anesthetic injection. If permission for an injection was given, the subject was informed that no injection would be performed and the assessment procedure was concluded. Individual scores were based on the number of items on the hierarchy completed by each subject. A list of the behaviors utilized is located in Appendix B.

Physiological Assessment

Since the early works of Hans Selye (1950), it has been generally accepted that adrenal-cortical activation is associated with both physical and mental stressful events (Persky, 1975). Plasma cortisol, a product of the pituitary-adrenal system, was used in the current study as a biochemical index of affective arousal. The pituitary-adrenal cortical system has been more thoroughly investigated than any other endocrine system with regard to the effects of psychological stimuli and there is now little doubt that these are among the most potent natural stimuli known to affect pituitary-adrenal cortical activity (Mason, 1968). More specifically, it appears that exposure to dental stimuli is sufficient to cause elevated plasma cortisol
levels in some individuals. In a series of studies, Shannon and his colleagues clearly demonstrated the impact of anticipation of dental procedures on the pituitary-adrenal system (Shannon, Prigmore, Hester, McCall, and Isbell, 1961; Shannon and Isbell, Note 7; Shannon, Prigmore, Hester, McCall and Isbell, Note 10; Shannon, Szmyd, and Prigmore, Note 11). For example, Shannon and Isbell (Note 7) reported that subjects who were scheduled to undergo tooth extraction had significantly higher plasma cortisol levels prior to the extraction than did a control group of subjects who were not scheduled for dental treatment both prior to and after anesthetic injections were given to both groups. Further, the induction of local anesthesia in these subjects produced a significant increase in cortisol levels, the magnitude of which was equal for both groups and therefore independent of the pre-injection levels. In a follow-up study, Shannon and Isbell (Note 7) demonstrated that the increased cortisol levels associated with anesthetic injection were independent of any physical trauma or pain associated with needle insertion. They found a comparable increase in cortisol levels from pre to post injection across five experimental conditions: actual anesthetic injection using two kinds of anesthesia, injection with saline, a condition in which the needle was inserted into the tissue but no solution was injected, and a condition in which the needle was placed into the mouth as if an injection were going to be given, but no needle insertion was actually made. The authors concluded that the increased levels of plasma cortisol were associated with "the frank realization by the patient
that he has to receive the injection and from the distress associated therewith" (p. 3). These data provide the rationale for utilization of plasma cortisol level as a measure of physiological arousal associated with stress.

In the present investigation 7 ml of blood were drawn from each subject during the pre and post treatment assessment sessions conducted in the dental office. A female medical technician entered the dental operatory where each subject had been left alone sitting in the dental chair with a dental bib in place. The blood was drawn from a vein on the inside of the arm closest to the doorway of each subject, using a 7 ml Vacutainer tube and a 21 guage, one and one-half inch needle. The blood was mixed with a premeasured portion of EDTA to prevent clotting and was immediately placed on ice. At the conclusion of the assessment session, the blood was transported to a laboratory where it was centrifuged at 3000 rpm for 20 minutes. The plasma was drawn off, and one ml was placed in each of three pre-coded containers and then frozen at -80 degrees F. All blood samples during pre and post assessment were collected between 6:30 and 9:00 p.m. This corresponds to the circadian phase of minimal cortisol secretion (Weitzman, Fukushima, Nogeire, Roffwarg, Gallagher, and Hellman, 1971), thus minimizing the possible confounding effect of variation in cortisol levels due to the circadian cycle.

Assay Procedure

Cortisol concentrations in the plasma samples were assessed using a radioimmunoassay procedure as outlined by Endocrine Sciences
(Endocrine Sciences, 1972) with minor modifications. The assay involved a single antibody competition between labelled and unlabelled cortisol. After incubation, the bound cortisol was removed by ammonium sulfate precipitation of the antibody. A portion of the remaining free cortisol was then counted in a Beckman LS-31500T liquid scintillation counter at 30% efficiency. For all samples 50 microliters of plasma sample were added to 1.5 ml of redistilled methanol for extraction of the steroidal compounds. Either 75 or 100 microliter samples of the supernatant were used for the determination of the cortisol values. The 75 microliter samples of extracted steroid provided 2.50 microliter serum equivalent per tube and the 100 microliter samples provided 3.33 microliter serum equivalent per tube. Concentration of cortisol was determined utilizing a linear plot of percent free/percent bound across a range of standardized samples with values of 2.5 to 75 micrograms/100 ml. All standard cortisol concentrations and samples were run in triplicate and a quality control sample was run with each assay.

Procedure

Subjects in each of the four experimental groups (stress inoculation, stress education, high fear - no treatment control, and low fear - validation control) each participated in identical pre- and post-treatment assessment sessions scheduled approximately six weeks apart. During that time interval the two treatment groups received five 90-minute intervention sessions; the control groups were not contacted. The pre-treatment assessment for all subjects consisted of
two phases: (1) orientation/self-report and (2) dental office assessment. Post-treatment assessment of all subjects was also identical and consisted of a dental office visit during which post-treatment self-report instruments were collected in addition to the behavioral and physiological assessment data. A ten month follow-up contact was made with each high fear subject who could be located. Details of their post-treatment dental contacts were obtained at that time. Low fear subjects were not contacted because the questions addressed in the study related to behavior change among high fear subjects.

All subjects who reported high stress levels when confronted with dental procedures, and who ultimately received treatment, were initially identified in one of three ways. Several responded to a media campaign designed to publicize the existence of an experimental program to treat "fear of dentistry". Other subjects were told of the program by their dentists who had been alerted to its existence through the mail followed by a follow-up phone call or personal contact by the experimenter. A third group had been identified as fearful of dental procedures through a mass screening procedure of introductory psychology students during which they completed the Dental Anxiety Scale (Corah, 1969). Those obtaining a score greater than 11 (1 S.D. above the mean) were contacted by telephone and told of the availability of the treatment program. Those students who declined treatment because of scheduling conflicts or the time requirement involved were given the option of receiving course credit for participating in an experiment designed to study "fear of dentistry", and served as
high fear - no treatment control subjects. Low fear subjects were also identified through a mass screening procedure using the Dental Anxiety Scale. Those scoring at least 1 standard deviation below the mean (5 or less) were contacted and invited to participate in the study in return for course credit.

**Orientation/Pre-treatment Assessment**

All subjects who had volunteered to participate in the treatment program were invited to attend an orientation session at which time a rationale for, and description of the program was provided. Included was information concerning the time requirements and specialized assessment procedures (blood draw and dental office visits). They were then asked to sign a statement of informed consent and to provide times and dates which would be convenient for group meetings. They then completed a demographic and dental history questionnaire which requested information about history of dental treatment, family attitudes toward dentistry, and expectancies of treatment success. Then each subject was asked to complete the following assessment instruments, which were presented in a random order to each subject: Dental Anxiety Scale (Corah, 1969), the Dental Fear Survey (Kleinknecht, Overcast and Klepac, Note A), Dental Self-Efficacy Scale, a Dental Self-Statement Inventory, the Fear Survey Schedule III (Wolpe and Lang, 1964), Internal-External Locus of Control Scale (Rotter, 1966), and Spielberger's State-Trait Anxiety Inventory (Spielberger, Gor-such and Lushene, 1970). Because of the length of time required to complete the several inventories, half were completed during the
meeting and others were taken home, with instructions to complete and return them prior to the first treatment session. Finally, each subject was scheduled for the dental office phase of pre-treatment assessment. Following the orientation meeting, the treatment subjects were randomly assigned to the two treatment groups, with the provision that an equal number of each sex be represented in the two groups. Treatment subjects were not told that different intervention strategies would be used for each group.

Subjects in the high fear-no treatment control group and in the low fear-validation control group attended separate orientation meetings during which they received information concerning time requirements and course credit. They completed the same forms, following the same procedure as did the treatment subjects and were also scheduled for an assessment session in the same dental office.

Dental Office Pre-treatment Assessment

Each assessment session was conducted in the same local dental office between approximately 6:30 and 9:00 pm. An average of six subjects participated in the assessment protocol on any given evening.

Upon arrival at the dental office subjects were seated in the waiting room and asked to complete the Profile of Moods Scale (McNair, et al., 1971) and a Dental Self-Statement Inventory. Upon completion of these forms, each subject in turn was taken to an adjacent room and told that he/she was to be seen by the dentist next. After a one minute waiting period, they were given a self-statement report form. After completing this form, the subject was introduced to a female
research assistant who conducted the Behavioral Avoidance Test. The assistant was blind to group membership. As each subject completed the BAT, he/she was thanked for participating and dismissed.

Treatment Procedures

**Stress Inoculation:** Subjects receiving stress inoculation training participated in five 90-minute group sessions, one week apart. Information presented verbally in each session was summarized in printed form and given to each subject prior to the beginning of each meeting. This procedure was designed to minimize the necessity for note-taking, to provide a permanent product of the session, and to serve as a prompt for study and review outside the session. The stress inoculation program provided to these subjects was based on a model for stress inoculation training described by Meichenbaum (1976) which consisted of three components: a) education about the causes and effects of stress, b) training in active coping skills, and c) practice in the use of those skills when confronted with analogues to the stimuli which originally elicited the stress response. Below is a brief outline of the material presented in each of the five sessions of stress inoculation training. A copy of the material which was distributed to each subject, containing details of each treatment session, is located in the Appendix.

Session 1: The first session began with an introduction of the therapist to the group members, and the members to each other. Information was presented as to the prevalence of dental fear in the general population and possible reasons why individuals have difficulty getting
over the problem by themselves. Stress was defined and physical signs of stress were described. An introduction to the cognitive factors associated with a stress reaction were presented and the first training session in a tension-release method of deep muscle relaxation was initiated.

Session 2: A description of the rationale behind stress inoculation training was presented, together with the three components which comprise it: education, coping skills training, and practice. The rationale for the use of the relaxation procedure was presented and the necessity for regular practice of the procedure was stressed. Instruction and practice in deep muscle relaxation concluded the session.

Session 3: Information concerning the use of appropriate assertive behavior in the dental situation as a coping skill was presented. Attention-change strategies as an adjunct to deep muscle relaxation were described and each subject was instructed in the development and use of such strategies as attention-diversion, imaginary manipulation, and somatization. Instruction and practice in deep muscle relaxation continued.

Session 4: The fourth session was devoted to instruction in the use of cognitive restructuring strategies designed to identify and challenge belief systems and assumptions that help to generate and maintain the stress reaction to dental stimuli. Instruction and practice of deep muscle relaxation continued.

Session 5: The fifth session was devoted to integrating and practicing
the full range of information and coping skills learned in the previous sessions. A 10 minute videotape with sound, of dental work being done, and viewed from the patient's perspective, was shown to the group. The same film has been used as an analogue to the dental situation in previous research and is capable of eliciting physiological changes in experimental subjects (Hirschman, Reland, Hawk, and Young, 1980). The visual stimuli of the dentist, dental assistant, and dental equipment in conjunction with sounds of drilling, scraping and suction provided a stimulus situation in which coping skills could be practiced. A general review of the treatment program was conducted and problems in utilizing coping skills were discussed and analyzed.

Stress Education. The stress education condition was conducted in a manner identical to that of stress inoculation training, i.e. five 90 minute group sessions, one week apart. The material that was presented, however, was limited to only that which comprised the education component of the stress inoculation program. In place of information concerning the use of coping skills such as deep muscle relaxation, and cognitive strategies for dealing with stress, there was an emphasis on group discussion of common dental experiences, fears, and other issues that were raised by the didactic presentation. In place of coping skills practice during the fifth and final group meeting, stress education subjects were visited by a dentist who answered factual questions about dentistry and displayed commonly used dental instruments. At no time during any of the five sessions were methods for actively coping with stress taught, demonstrated, or
discussed.

The rationale for this approach was described as being based on the theory that the best way to overcome stress was to understand it. The encouragement and "moral support" obtained through group discussion of commonly held fears were described as useful adjuncts to the educative process. Below is a brief description of the didactic material presented during each session of the stress education condition. A detailed account of each session, as summarized in materials given to subjects is located in Appendix 3.

Session 1: The first session consisted of an introduction of the therapist to the group members and the members to each other. Information was presented as to the prevalence of dental fear in the general population and possible reasons why individuals have trouble conquering the problems by themselves. Subjects were encouraged to discuss their reasons for participating in the program.

Session 2: The rationale behind stress education and information concerning the cyclical nature of stress was presented. The evolutionary significance of the stress reaction was described in relation to the fight-flight mechanisms. A discussion of the beneficial aspects of the stress reaction was encouraged.

Session 3: The physical signs of stress were described. In group discussion, subjects were encouraged to identify their own individual physical reactions to dental stimuli and to compare and contrast them with the reactions of other group members.

Session 4: The role of cognitive factors in maintaining the stress
reaction was discussed. Examples of negative self-statements were provided and group members were encouraged to identify and share their own negative self-statements generated in response to dental stimuli. A review of the "vicious cycle of stress" was conducted.

Session 5: A local dentist visited the group and answered questions about dental procedures, dental training and other aspects of dentistry. He displayed commonly used dental instruments to the group members. In conclusion, an opportunity to discuss material previously presented was provided.

**Post-Treatment Dental Office Assessment**

Post-treatment assessment involving the self-report scales, cortisol values, and the behavioral avoidance test was conducted approximately one week post-treatment (six weeks after pre-treatment assessment). Control subjects were not contacted during the 5 week treatment period except to schedule the post-treatment assessment session. Post-treatment self-report instruments were completed in the dental office waiting room at the conclusion of the Behavioral Avoidance Test.
Results

Experimental Checks

Because high fear subjects were not randomly assigned to groups (high fear control subjects had declined treatment), it was necessary to determine whether there were significant differences between the high fear groups at pre-treatment. Pre-planned comparisons were therefore conducted for all variables using the Duncan Multiple Range Test (p=.05). Analysis of these data revealed no significant differences between groups for the following descriptive variables: months since last dental checkup, months since last dental treatment, mother's attitude toward dental treatment, and father's attitude toward dental treatment.

With regard to behavioral, self-report, and physiological indices of stress, results indicated that high fear subjects did not differ statistically at pre-treatment on levels of behavioral approach to dental stimuli, dental anxiety, level or strength of self-efficacy, positive or negative self-statements, number of feared objects in the general environment, state anxiety, trait anxiety, or plasma cortisol levels.

A comparison of the two treatment groups revealed no significant difference in expectancy for treatment success or age. There was a difference between the mean age of the stress education (X=29.56 years) and the high fear control group (X=20.00 years). Table 2 provides the pretreatment means and standard deviations of all variables for the three experimental groups composed of high fear subjects.
Table 2:
Pre-treatment means and standard deviations for each high fear group on all variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Stress Inc. M</th>
<th>SD</th>
<th>Stress Educ. M</th>
<th>SD</th>
<th>High Fear Con. M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>26.33</td>
<td>6.46</td>
<td>29.56*</td>
<td>10.16</td>
<td>20.00*</td>
<td>2.00</td>
</tr>
<tr>
<td>Months since last check-up</td>
<td>32.13</td>
<td>41.91</td>
<td>10.13</td>
<td>10.25</td>
<td>18.71</td>
<td>25.29</td>
</tr>
<tr>
<td>Months since last dental treatment</td>
<td>31.44</td>
<td>35.38</td>
<td>10.44</td>
<td>9.30</td>
<td>21.43</td>
<td>38.32</td>
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<tr>
<td>Mother's attitude toward dental treatment</td>
<td>4.67</td>
<td>2.06</td>
<td>4.86</td>
<td>1.22</td>
<td>4.57</td>
<td>1.81</td>
</tr>
<tr>
<td>Father's attitude toward dental treatment</td>
<td>5.33</td>
<td>1.18</td>
<td>4.38</td>
<td>1.92</td>
<td>4.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Will program help you reach your goal?</td>
<td>2.50</td>
<td>.93</td>
<td>3.00</td>
<td>1.00</td>
<td>----</td>
<td>----</td>
</tr>
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<td>Behavioral avoidance test</td>
<td>7.44</td>
<td>2.41</td>
<td>8.11</td>
<td>.93</td>
<td>7.57</td>
<td>1.13</td>
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<td>Dental anxiety scale</td>
<td>14.67</td>
<td>3.84</td>
<td>14.33</td>
<td>4.47</td>
<td>13.29</td>
<td>1.25</td>
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<td>DFS Factor 1 -- Anticipation</td>
<td>28.22</td>
<td>9.08</td>
<td>25.22</td>
<td>8.23</td>
<td>22.71</td>
<td>4.39</td>
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<td>DFS Factor 2 -- Pain</td>
<td>24.67</td>
<td>5.90</td>
<td>23.67</td>
<td>6.04</td>
<td>23.86</td>
<td>3.85</td>
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<tr>
<td>DFS Factor 3 -- Physiological Response</td>
<td>22.00</td>
<td>5.57</td>
<td>20.78</td>
<td>6.82</td>
<td>17.86</td>
<td>5.11</td>
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<tr>
<td>DFS Overall Fear Rating</td>
<td>4.56</td>
<td>.73</td>
<td>3.78</td>
<td>1.39</td>
<td>4.04</td>
<td>.58</td>
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<tr>
<td>Dental Fear Survey Total Score</td>
<td>73.00</td>
<td>16.36</td>
<td>68.11</td>
<td>19.29</td>
<td>63.14</td>
<td>8.75</td>
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<td>Self-Efficacy Level</td>
<td>7.56</td>
<td>2.83</td>
<td>9.29</td>
<td>1.89</td>
<td>9.33</td>
<td>1.21</td>
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<tr>
<td>Self-Efficacy Strength</td>
<td>59.67</td>
<td>34.52</td>
<td>79.43</td>
<td>22.94</td>
<td>60.50</td>
<td>19.83</td>
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<tr>
<td>Negative Self-statements</td>
<td>31.89</td>
<td>7.93</td>
<td>30.33</td>
<td>12.81</td>
<td>31.29</td>
<td>6.70</td>
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<td>Positive Self-statements</td>
<td>22.89</td>
<td>7.85</td>
<td>25.67</td>
<td>6.71</td>
<td>22.71</td>
<td>8.44</td>
</tr>
<tr>
<td>Tension/Anxiety -- Profile of Mood Scale</td>
<td>20.00</td>
<td>9.75</td>
<td>20.00</td>
<td>10.20</td>
<td>19.00</td>
<td>9.78</td>
</tr>
<tr>
<td>Fear Survey Schedule III</td>
<td>10.80</td>
<td>8.96</td>
<td>11.17</td>
<td>14.81</td>
<td>22.71</td>
<td>9.93</td>
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<td>Internal-External Locus of Control</td>
<td>12.00</td>
<td>4.30</td>
<td>11.33</td>
<td>4.37</td>
<td>11.86</td>
<td>3.98</td>
</tr>
<tr>
<td>STAI -- State Anxiety</td>
<td>45.11</td>
<td>13.43</td>
<td>55.44</td>
<td>19.54</td>
<td>50.86</td>
<td>13.06</td>
</tr>
<tr>
<td>STAI -- Trait Anxiety</td>
<td>37.11</td>
<td>10.28</td>
<td>38.13</td>
<td>13.27</td>
<td>46.43</td>
<td>12.84</td>
</tr>
<tr>
<td>Plasma Cortisol</td>
<td>19.92</td>
<td>13.95</td>
<td>19.12</td>
<td>8.82</td>
<td>15.19</td>
<td>5.93</td>
</tr>
</tbody>
</table>

*Mean age of stress education and high fear control subjects are significantly different, p<.05.

Between group comparisons on all other means are not significant.
Validation of Dependent Variables

The present study required the creation or adaptation of several assessment techniques. Therefore, prior to discussing treatment results, the validity of these techniques, as defined by their ability to discriminate high from low fear subjects at pre-treatment will be presented. For purposes of this analysis, all high fear subjects were combined into one group. The low fear validation group was then compared with this combined high fear group on each variable by the use of t tests. The group means, standard deviations, and t test values are presented in Table 3. Each variable, with the exception of locus of control and number of positive self-statements, was found to significantly discriminate between high and low fear groups, providing evidence that each had the potential for identifying treatment effects at post treatment.

Correlations Between Dependent Variables at Pre-treatment

The correlations of the various measures with each other are presented in Table 4. It should be noted first that no relationship existed among subjects' age and the dependent variables utilized to assess treatment effects. This finding is especially relevant in light of the significant age differences found to exist between the subjects in the stress education and the high fear control groups. Of the measures not specifically designed to assess treatment effects, the rating of mother's attitude toward dental treatment is most striking in that this variable was significantly correlated with every other variable, except plasma cortisol level. As would be
Table 3:
Mean scores, standard deviations, and t-test values on all variables for high and low fear subjects at pre-treatment.

<table>
<thead>
<tr>
<th>Descriptive Variable</th>
<th>High Fear (N=23)</th>
<th>Low Fear (N=12)</th>
<th>t</th>
<th>df</th>
<th>p(2-tail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>25.72</td>
<td>21.08</td>
<td>1.63</td>
<td>35.0</td>
<td>NS</td>
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<tr>
<td>Months since last checkup</td>
<td>20.39</td>
<td>4.58</td>
<td>5.09</td>
<td>2.32</td>
<td>24.3*</td>
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<tr>
<td>Months since last dental treatment</td>
<td>21.08</td>
<td>23.18</td>
<td>27.87</td>
<td>-.20</td>
<td>34.0</td>
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<td>Mother's attitude toward dental treatment</td>
<td>4.70</td>
<td>6.50</td>
<td>.67</td>
<td>-4.48</td>
<td>31.6*</td>
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<td>Father's attitude toward dental treatment</td>
<td>4.63</td>
<td>6.41</td>
<td>1.16</td>
<td>-3.25</td>
<td>34.0</td>
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<table>
<thead>
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<th>Treatment Variable</th>
<th>High Fear (N=23)</th>
<th>Low Fear (N=12)</th>
<th>t</th>
<th>df</th>
<th>p(1-tail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral Avoidance Test (BAT)</td>
<td>7.72</td>
<td>8.75</td>
<td>.45</td>
<td>-2.87</td>
<td>30.3*</td>
</tr>
<tr>
<td>Dental Anxiety Scale (DAS)</td>
<td>14.16</td>
<td>5.17</td>
<td>.94</td>
<td>11.96</td>
<td>30.2*</td>
</tr>
<tr>
<td>DFS Total Score</td>
<td>68.48</td>
<td>24.92</td>
<td>4.01</td>
<td>12.98</td>
<td>29.7*</td>
</tr>
<tr>
<td>DFS Factor 1 - Anticipation</td>
<td>25.60</td>
<td>8.33</td>
<td>.89</td>
<td>11.00</td>
<td>25.3*</td>
</tr>
<tr>
<td>DFS Factor 2 - Pain</td>
<td>24.08</td>
<td>9.00</td>
<td>2.70</td>
<td>11.52</td>
<td>34.7*</td>
</tr>
<tr>
<td>DFS Factor 3 - Physiological</td>
<td>20.40</td>
<td>7.67</td>
<td>1.44</td>
<td>10.12</td>
<td>29.3*</td>
</tr>
<tr>
<td>DFS Overall Fear Rating</td>
<td>4.12</td>
<td>1.08</td>
<td>.29</td>
<td>13.86</td>
<td>30.9*</td>
</tr>
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<td>Self-Efficacy Level (DSS)</td>
<td>8.59</td>
<td>10.00</td>
<td>0.00</td>
<td>-2.90</td>
<td>21*</td>
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<tr>
<td>Self-Efficacy Strength (DSS)</td>
<td>66.18</td>
<td>96.82</td>
<td>4.90</td>
<td>-5.00</td>
<td>23.3*</td>
</tr>
<tr>
<td>Positive Self-Statements (DSSI)</td>
<td>23.84</td>
<td>27.75</td>
<td>9.63</td>
<td>-1.36</td>
<td>35</td>
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<tr>
<td>Negative Self-Statements (DSSI)</td>
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<td>5.66</td>
<td>33.4*</td>
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<td>Tension/Anxiety Factor--POMS</td>
<td>19.71</td>
<td>5.00</td>
<td>6.28</td>
<td>4.85</td>
<td>34</td>
</tr>
<tr>
<td>Fear Survey Schedule (FSS III)</td>
<td>15.55</td>
<td>5.00</td>
<td>9.30</td>
<td>2.52</td>
<td>28</td>
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<td>Locus of Control (IE)</td>
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<td>10.42</td>
<td>4.85</td>
<td>.81</td>
<td>23</td>
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<tr>
<td>STAI -- State Anxiety</td>
<td>50.44</td>
<td>26.42</td>
<td>6.56</td>
<td>6.51</td>
<td>34.6*</td>
</tr>
<tr>
<td>STAI -- Trait Anxiety</td>
<td>40.17</td>
<td>31.83</td>
<td>8.50</td>
<td>2.11</td>
<td>34</td>
</tr>
<tr>
<td>Plasma Cortisol (ng/100 ml)</td>
<td>18.21</td>
<td>10.36</td>
<td>10.95</td>
<td>1.85</td>
<td>23</td>
</tr>
</tbody>
</table>

*pValues adjusted for unequal variances.
|       | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 Age |     | .03 | -.12| .01 | .16 | -.11| .07 | .16 | .06 | .10 | .07 | .11 | -.10| -.05| -.09| -.20| -.06| -.22| -.18| -.04| -.05| -.06|
| 2 Mth's last check |     | -.68 | .29 | -.03 | -.66 | .46 | .51 | .46 | .38 | .38 | -.48 | .44 | .44 | .57 | .15 | .27 | .27 | .21 | .28 | .08 | -.03 | .50 |
| 3 Mth's Last treat |     | .07 | .19 | -.25 | .05 | .09 | .08 | .03 | .02 | .07 | -.10 | -.17 | -.15 | -.11 | -.10 | .00 | .16 | -.20 | -.18 | -.20 |
| 4 Mother's attitude |     | .67 | .59 | -.56 | -.52 | -.54 | -.43 | -.48 | -.51 | -.51 | .68 | -.43 | -.64 | -.45 | -.48 | -.45 | -.55 | -.44 | -.18 | .18 |
| 5 Father's attitude |     | -.06 | .45 | -.29 | .43 | -.36 | -.46 | -.37 | .07 | .22 | -.26 | -.51 | -.24 | -.30 | -.23 | -.35 | -.29 | -.26 |
| 6 Anxiety |     | -.04 | .46 | -.51 | -.44 | -.35 | -.33 | -.46 | -.50 | -.67 | .42 | -.35 | -.49 | -.48 | -.44 | -.37 | -.35 | -.38 |
| 7 DAS |     | -.92 | .89 | .91 | .95 | -.45 | -.72 | -.23 | .77 | .80 | .60 | .37 | .75 | .60 | .60 | .37 | .67 | .50 | .50 |
| 8 Anticipate |     | .85 | .89 | .96 | .62 | .78 | .23 | .67 | .79 | .51 | .39 | .71 | .50 | .50 | .50 | .50 | .50 | .50 | .50 |
| 9 Pain |     | .86 | .86 | .94 | .50 | .74 | .23 | .73 | .72 | .60 | .32 | .71 | .51 | .50 | .50 | .50 | .50 | .50 | .50 |
| 10 Physio. |     | -.91 | .96 | .41 | -.62 | .22 | .68 | .82 | .56 | .26 | .67 | .32 | .49 |
| 11 Fear |     | -.94 | .42 | -.63 | .18 | .68 | .73 | .50 | .25 | .70 | .30 | .40 |
| 12 DFS Total |     | -.32 | -.75 | -.23 | .73 | .82 | .60 | .32 | .74 | .64 | .46 |
| 13 Level of self-effic. |     | .81 | .26 | -.24 | -.41 | -.21 | -.16 | -.35 | -.25 | -.23 |
| 14 Strength of self-effic. |     | .42 | -.60 | -.68 | -.64 | -.33 | .62 | -.46 | .10 |
| 15 Positive Self-State |     | -.27 | -.27 | -.10 | -.08 | -.21 | -.22 | .16 |
| 16 Negative Self-State |     | .75 | -.60 | .42 | .68 | .53 | .21 |
| 17 Tension Anxiety |     | .85 | .40 | .78 | .56 | .55 |
| 18 FSS III |     | -.46 | .72 | .70 | .44 |
| 19 IE |     | .33 | .58 | .38 |
| 20 State Anxiety |     | .52 | .39 |
| 21 Trait |     | .17 |
| 22 Cortisol |     | .05 | .001 | .001 | .001 | .001 | .001 |

1 = Age; 2 = Months since last checkup; 3 = months since last dental treatment; 4 = Mother's attitude toward dental treatment; 5 = Father's attitude toward dental treatment; 6 = Behavioral Avoidance Test; 7 = Dental Anxiety Scale; 8 = Anticipation Factor of the Dental Fear Survey; 9 = Pain Factor of the Dental Fear Survey; 10 = Physiological Factor on the Dental Fear Survey; 11 = Overall rating of fear of dental treatment; 12 = Dental Fear Survey total score; 13 = Level of Self-efficacy; 14 = Strength of Self-efficacy; 15 = Number of positive self-statements; 16 = Number of Negative self-statements; 17 = Tension Anxiety Factor of the Profile of Mood Scale; 18 = Fear Survey Schedule III; 19 = Internal-External Locus of Control Scale; 20 = State anxiety scale (STAI); 21 = Trait Anxiety Scale (STAI); 22 = plasma cortisol level.
expected, almost all self-report indices correlated with each other. Notable exceptions are Rotter's Locus of Control Scale and number of positive self-statements. Some additional evidence for the validity of the two indices of dental fear, the Dental Anxiety Scale and the Dental Fear Survey, is provided by their correlations with the behavioral (BAT) and physiological (plasma cortisol) measures thought to be associated with stress and anxiety. The variables designed to assess cognitive processes correlated with both self-reported fear and behavioral avoidance, but failed to predict physiological arousal.

A strong correlation (r=.70, p<.0001) was found between trait anxiety and the number of objects reported to elicit strong fear on the Fear Survey Schedule III. Measures of general state anxiety predicted the trait measure more accurately than did measures specific to dental anxiety. Items on the Dental Fear Survey that predicted trait anxiety were, for the most part, related to pain. The trait measure also correlated with negative self-statements and the locus of control variable, with external subjects tending to experience higher levels of trait anxiety.

Among the behavioral measures, subjects' actual approach behavior to dental stimuli, as measured by the behavioral avoidance test, successfully predicted self-reported approach behavior (months since last dental check-up). In addition, estimates provided by each subject as to their ability to perform behaviors related to dental treatment proved to be good predictors of their actual behavior, as can be seen by the correlations between the behavioral avoidance test
and the level and strength of self-efficacy. In fact, an examination of Table 4 shows that actual approach behavior was significantly correlated with every dependent measure utilized to assess treatment effects, including plasma cortisol levels ($r = -0.38$, $p < 0.05$).

In addition to predicting approach to dental stimuli, Table 4 shows that plasma cortisol levels also were significantly related to scores on the Dental Anxiety Scale, the Dental Fear Survey, and the tension-anxiety factor of the Profile of Moods Scale. Also related to plasma cortisol levels were the anticipation and physiological factors of the Dental Fear Survey. In addition, high cortisol levels predicted more items on the Fear Survey Schedule being rated as fear-producing. Somewhat surprisingly, the STAI measure of state anxiety, completed immediately before the blood sample from which cortisol levels were obtained, was not significantly related to plasma cortisol levels. The failure of the cognitive measures (self-efficacy, self-statements) to predict cortisol levels was equally surprising, especially in light of the fact that most cognitive theories of behavior suggest that arousal is, to a large degree, a function of cognition.

**Treatment Results: Introduction and Descriptive Analyses**

For each variable, pre treatment to post treatment intra-group differences were analyzed using a repeated measures analysis of variance procedure. To assess between group differences at post treatment, an analysis of covariance procedure was utilized for each variable, using the pre treatment score as the covariate. Treatment
results can therefore be assessed from two perspectives: 1) did subjects in each group change from pre to post treatment? and 2) at post treatment, were there significant differences between groups after variance associated with pretreatment scores had been statistically removed? Prior to discussing the results of the statistical analyses however, descriptive data are presented in Tables 5 and 6. These are simple descriptions of the raw data by groups presented as an aid to interpreting the results of the statistical analyses which will follow. Table 5 provides the mean and standard deviation of each variable at pre and post treatment, by experimental group. The percent improvement represented by these pre to post test differences are given in Table 6 for each group. As can be seen in Table 6, the stress inoculation subjects appear to show superior results in areas of behavioral avoidance, cognitions (self-efficacy and self-statements) and trait anxiety. The stress education subjects appear to have fared somewhat better on most self-reported anxiety measures, but similar improvements associated with the high fear control group make this observation uninterpretable. A decrease in plasma cortisol levels of the magnitude of near 50 percent by both treatment groups suggests that physiological arousal was impacted by the two intervention procedures, especially in light of the small reduction seen in the high fear condition.

Treatment Results: Statistical Analyses

1. Self-reported Anxiety Measures. Table 7 presents the results of the repeated measures analysis of variance. As can be
Table 5:
Means and standard deviations at pre- and post-treatment for stress inoculation, stress education, high fear no treatment, and low fear validation groups on all dependent variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>STRESS INOCULATION</th>
<th>STRESS EDUCATION</th>
<th>HIGH FEAR-NO TREATMENT</th>
<th>LOW FEAR VALIDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRE M SD</td>
<td>POST M SD</td>
<td>PRE M SD</td>
<td>POST M SD</td>
</tr>
<tr>
<td>Behavioral Avoidance Test</td>
<td>7.44 2.51</td>
<td>8.13 1.13</td>
<td>8.11 .91</td>
<td>8.20 .45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7.57 1.13</td>
<td>7.71 .95</td>
</tr>
<tr>
<td>Dental Anxiety Scale</td>
<td>14.67 3.04</td>
<td>11.75 5.18</td>
<td>14.33 4.47</td>
<td>9.60 3.44</td>
</tr>
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<td></td>
<td></td>
<td>13.29 1.25</td>
<td>11.29 1.98</td>
</tr>
<tr>
<td>Dental Fear Survey -- Total</td>
<td>71.00 16.36</td>
<td>57.00 22.37</td>
<td>68.11 19.26</td>
<td>51.00 18.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>63.14 8.75</td>
<td>53.71 13.15</td>
</tr>
<tr>
<td>DPS Factor 1 -- Anticipation</td>
<td>28.22 9.08</td>
<td>20.88 10.44</td>
<td>25.22 8.23</td>
<td>18.80 7.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>22.71 4.39</td>
<td>20.14 5.70</td>
</tr>
<tr>
<td>DPS Factor 2 -- Pain</td>
<td>24.67 5.90</td>
<td>19.50 7.35</td>
<td>23.67 6.04</td>
<td>19.40 6.58</td>
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<td></td>
<td></td>
<td></td>
<td>23.86 3.85</td>
<td>22.17 7.30</td>
</tr>
<tr>
<td>DPS Factor 3 -- Physiological</td>
<td>22.00 5.57</td>
<td>17.50 8.05</td>
<td>20.78 6.82</td>
<td>15.40 5.90</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>17.86 5.11</td>
<td>15.29 5.53</td>
</tr>
<tr>
<td>DPS Overall Fear Rating</td>
<td>4.56 .73</td>
<td>3.13 1.25</td>
<td>3.79 1.39</td>
<td>3.00 1.00</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>4.00 .58</td>
<td>3.57 .54</td>
</tr>
<tr>
<td>Self-Efficacy Level</td>
<td>7.56 2.83</td>
<td>9.63 1.13</td>
<td>9.29 1.89</td>
<td>9.80 .45</td>
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<td>9.33 1.21</td>
<td>7.71 1.50</td>
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<td>Self-Efficacy Strength</td>
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<td>81.71 17.86</td>
<td>79.63 22.94</td>
<td>86.60 14.08</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>60.50 19.83</td>
<td>48.71 17.43</td>
</tr>
<tr>
<td>Negative Self-Statements</td>
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<td>24.75 8.48</td>
<td>30.33 12.81</td>
<td>25.80 7.86</td>
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<td></td>
<td>13.29 6.70</td>
<td>10.20 8.36</td>
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<tr>
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<td>22.89 7.85</td>
<td>26.38 8.80</td>
<td>25.67 6.71</td>
<td>26.80 8.70</td>
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<tr>
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<td></td>
<td></td>
<td>22.71 8.44</td>
<td>24.56 7.64</td>
</tr>
<tr>
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<td>12.13 9.46</td>
<td>20.00 10.20</td>
<td>10.60 8.29</td>
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<td></td>
<td>19.00 9.78</td>
<td>10.71 6.97</td>
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<td>Fear Survey Schedule III</td>
<td>10.80 8.96</td>
<td>7.43 9.95</td>
<td>11.17 14.81</td>
<td>6.20 8.56</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>22.71 9.93</td>
<td>15.50 11.88</td>
</tr>
<tr>
<td>Internal-External Locus of Control</td>
<td>12.00 4.30</td>
<td>11.13 4.16</td>
<td>11.33 4.37</td>
<td>10.20 4.15</td>
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<td></td>
<td></td>
<td></td>
<td>11.85 3.98</td>
<td>11.71 4.54</td>
</tr>
<tr>
<td>STAI -- State Anxiety</td>
<td>45.11 13.53</td>
<td>45.38 16.72</td>
<td>55.54 19.54</td>
<td>43.60 13.01</td>
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<tr>
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<td></td>
<td></td>
<td>50.86 13.06</td>
<td>45.29 12.88</td>
</tr>
<tr>
<td>STAI -- Trait Anxiety</td>
<td>37.11 10.28</td>
<td>32.63 5.93</td>
<td>38.13 13.27</td>
<td>39.25 10.15</td>
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<td></td>
<td></td>
<td></td>
<td>46.41 12.84</td>
<td>46.29 11.16</td>
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<tr>
<td>Plasma Cortisol (mg/100 ml)</td>
<td>19.92 13.95</td>
<td>10.09 5.82</td>
<td>19.12 8.82</td>
<td>10.14 3.19</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>15.19 5.93</td>
<td>13.11 5.61</td>
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<td></td>
<td></td>
<td></td>
<td>10.95 10.37</td>
<td>11.03 3.28</td>
</tr>
</tbody>
</table>
Table 6:
Percent improvement from pre- to post-test for stress inoculation, stress education, high fear control and low fear validation groups across all variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Stress Inocu.</th>
<th>Stress Educa.</th>
<th>Hi Fear Con.</th>
<th>Lo Fear Con.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral Avoidance Test</td>
<td>9.30%</td>
<td>1.10%</td>
<td>1.85%</td>
<td>.91%</td>
</tr>
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<td>Dental Anxiety Scale</td>
<td>19.90</td>
<td>33.00</td>
<td>15.12</td>
<td>-1.50</td>
</tr>
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<td>Dental Fear Survey -- Total</td>
<td>21.92</td>
<td>25.12</td>
<td>14.94</td>
<td>.52</td>
</tr>
<tr>
<td>DFS Factor 1 - Anticipation</td>
<td>26.00</td>
<td>25.46</td>
<td>11.32</td>
<td>0.00</td>
</tr>
<tr>
<td>DFS Factor 2 - Pain</td>
<td>20.96</td>
<td>18.04</td>
<td>4.82</td>
<td>2.78</td>
</tr>
<tr>
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<td>20.45</td>
<td>25.89</td>
<td>14.39</td>
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<td>20.63</td>
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<td>7.77</td>
<td>-19.49</td>
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<td>4.40</td>
<td>8.19</td>
<td>10.81</td>
</tr>
<tr>
<td>Positive Self-Statements</td>
<td>22.93</td>
<td>14.94</td>
<td>3.20</td>
<td>15.35</td>
</tr>
<tr>
<td>Tension/Anxiety Factor--POMS</td>
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<td>47.00</td>
<td>43.63</td>
<td>.20</td>
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<td>-10.00</td>
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<td>Inter/Exter Locus of Control</td>
<td>7.25</td>
<td>9.97</td>
<td>1.13</td>
<td>8.05</td>
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<td>STAI -- State Anxiety</td>
<td>.60</td>
<td>17.75</td>
<td>10.95</td>
<td>-3.14</td>
</tr>
<tr>
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<td>-2.94</td>
<td>.32</td>
<td>-2.10</td>
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<tr>
<td>Plasma Cortisol (µg/100 ml)</td>
<td>49.35</td>
<td>46.97</td>
<td>13.70</td>
<td>-.73</td>
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</table>
Table 7:
Pre- and post-treatment means and F-values for intra-group comparisons for stress inoculation, stress education, and high fear control groups for all variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Stress Inoculation</th>
<th>Stress Education</th>
<th>High Fear Control</th>
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<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>F-Value</td>
</tr>
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<td>1.77</td>
</tr>
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<td>Dental Fear Survey Total</td>
<td>73.00</td>
<td>57.00</td>
<td>2.88</td>
</tr>
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<td>DFS Factor 1 -- Anticipation</td>
<td>28.22</td>
<td>20.88</td>
<td>2.41</td>
</tr>
<tr>
<td>DFS Factor 2 -- Pain</td>
<td>24.67</td>
<td>19.50</td>
<td>2.59</td>
</tr>
<tr>
<td>DFS Factor 3 -- Physiological</td>
<td>22.00</td>
<td>17.50</td>
<td>1.83</td>
</tr>
<tr>
<td>DFS Overall Fear Rating</td>
<td>4.56</td>
<td>3.13</td>
<td>8.61</td>
</tr>
<tr>
<td>Self-Efficacy Level</td>
<td>7.56</td>
<td>9.43</td>
<td>2.69</td>
</tr>
<tr>
<td>Self-Efficacy Strength</td>
<td>59.67</td>
<td>81.81</td>
<td>2.34</td>
</tr>
<tr>
<td>Negative Self-Statements</td>
<td>31.89</td>
<td>24.75</td>
<td>3.22</td>
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<td>Positive Self-Statements</td>
<td>22.89</td>
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</tr>
<tr>
<td>Tension Anxiety Factor -- POMS</td>
<td>20.00</td>
<td>12.13</td>
<td>2.84</td>
</tr>
<tr>
<td>Fear Survey Schedule III</td>
<td>10.80</td>
<td>7.43</td>
<td>1</td>
</tr>
<tr>
<td>Internal--External Locus of Control</td>
<td>12.00</td>
<td>11.13</td>
<td>1</td>
</tr>
<tr>
<td>STAI -- State Anxiety</td>
<td>45.41</td>
<td>13.53</td>
<td>1</td>
</tr>
<tr>
<td>STAI -- Trait Anxiety</td>
<td>37.11</td>
<td>32.63</td>
<td>1.17</td>
</tr>
<tr>
<td>Plasma Cortisol (µg/100 ml)</td>
<td>19.92</td>
<td>10.09</td>
<td>3.33</td>
</tr>
</tbody>
</table>

*Significance level set at .10 because of unidirectional nature of hypotheses.
seen, only two self-reported anxiety measures showed significant differences from pre to post treatment. Stress education subjects showed a drop in the Dental Anxiety Scale scores from a mean of 14.33 to 9.60, F (1, 12)=4.17, p < .065. The fact that there was also a significant drop on this variable (13.29 to 11.28) by the high fear control subjects however, F (1, 12)=5.11, p < .045, makes it impossible to clearly attribute the change to the effects of the stress education intervention. Stress inoculation subjects on the other hand, showed a significant reduction in their overall rating of fear of dentistry, changing from a mean rating of 4.65 (much) to one of 3.13 (somewhat), F (1, 15)=8.61, p < .011. No comparable pre to post treatment change on this variable was evidenced by either the stress education or the high fear control group.

Table 8 presents the results of the analysis of covariance on the self-report measures. Inspection of the adjusted group means of the self-reported anxiety measures at post treatment indicates that this statistical treatment yielded slightly different results, although as with the repeated measures analysis, the majority of self-reported anxiety measures appear to have been unaffected by either of the two intervention procedures. Analysis of Covariance (ANCOVA), results showed there to be significant between-group differences for the overall rating of fear of dentistry, F (3, 27)=2.80, p < .06. Pre-planned comparisons between the adjusted group means revealed that at post-treatment, the high fear control subjects had significantly higher ratings of overall fear at post treatment than
Table 8:
Adjusted post-treatment means and standard deviations for stress inoculation, stress education, high fear control and low fear validation groups across all variables for the analysis of covariance.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Stress Inoc. M</th>
<th>Stress Ed. M</th>
<th>HI Fear Con. M</th>
<th>Lo Fear Valid. M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Behavioral Avoidance Test</td>
<td>.16</td>
<td>8.64*</td>
<td>.16</td>
<td>8.07</td>
</tr>
<tr>
<td>Dental Anxiety Scale</td>
<td>.16</td>
<td>9.04</td>
<td>.16</td>
<td>7.43</td>
</tr>
<tr>
<td>DFS Overall Fear Rating</td>
<td>.36</td>
<td>2.48*</td>
<td>.36</td>
<td>2.81</td>
</tr>
<tr>
<td>DFS Factor 1 -- Anticipation</td>
<td>.55</td>
<td>13.16*</td>
<td>.55</td>
<td>13.41</td>
</tr>
<tr>
<td>DFS Factor 2 -- Pain</td>
<td>.87</td>
<td>14.26</td>
<td>.87</td>
<td>16.08</td>
</tr>
<tr>
<td>DFS Factor 3 -- Physiological</td>
<td>.55</td>
<td>12.30</td>
<td>.55</td>
<td>11.85</td>
</tr>
<tr>
<td>Dental Fear Survey Total</td>
<td>.46</td>
<td>36.24</td>
<td>.46</td>
<td>37.46</td>
</tr>
<tr>
<td>Self-efficacy Level</td>
<td>.40</td>
<td>9.68*</td>
<td>.40</td>
<td>9.78</td>
</tr>
<tr>
<td>Self-efficacy Strength</td>
<td>.82</td>
<td>88.94*</td>
<td>.82</td>
<td>86.71</td>
</tr>
<tr>
<td>Negative Self-statements</td>
<td>1.93</td>
<td>2.128</td>
<td>2.31</td>
<td>2.55</td>
</tr>
<tr>
<td>Positive Self-statements</td>
<td>2.94</td>
<td>27.34</td>
<td>3.13</td>
<td>26.09</td>
</tr>
<tr>
<td>Tension/Anxiety Factor-POMS</td>
<td>.70</td>
<td>8.82</td>
<td>.70</td>
<td>8.82</td>
</tr>
<tr>
<td>Fear Survey Schedule III</td>
<td>.49</td>
<td>4.70</td>
<td>.49</td>
<td>6.97</td>
</tr>
<tr>
<td>Inter/Ext. Locus of Control</td>
<td>.19</td>
<td>9.54</td>
<td>.19</td>
<td>11.38</td>
</tr>
<tr>
<td>STAI -- State Anxiety</td>
<td>.83</td>
<td>42.73</td>
<td>.83</td>
<td>39.52</td>
</tr>
<tr>
<td>STAI -- Trait Anxiety</td>
<td>.44</td>
<td>32.39</td>
<td>.44</td>
<td>35.09</td>
</tr>
<tr>
<td>Plasma Cortisol</td>
<td>1.62</td>
<td>9.61</td>
<td>1.62</td>
<td>9.76</td>
</tr>
</tbody>
</table>

*Significantly different from the high fear control group, p < .05.
did either the stress inoculation subjects ($p < .095$) or the low fear validation sample ($p < .03$). The stress education subjects did not differ significantly from either group of high fear subjects.

Unlike the repeated measures analysis however, the ANCOVA results suggested the presence of a treatment effect on trait anxiety, $F(3, 25) = 2.01, p < .138$. While the pre-post repeated measures analysis of trait anxiety indicated no significant reduction in anxiety as a result of either of the two treatments, pre-planned comparisons of the adjusted group means indicated that the mean of the stress inoculation subjects at post-treatment ($\bar{X} = 32.39$) was significantly lower than that of the no treatment control group ($\bar{X} = 41.58$), $p < .02$. The stress education group did not differ from either of the other high fear groups.

2. **Cognitive Measures.** Analyses of pre to post treatment intra-group differences on the cognitive variables revealed that only the stress inoculation subjects reported significant reductions in negative self-statements, $F(1, 15) = 3.22, p < .095$. There were no significant improvements in either level or strength of self-efficacy for any group, although the stress inoculation subjects reported increases in both self-efficacy measures that approached significance (see Table 7). Similarly, there were no significant changes in positive self-statements.

For the negative self-statement variable, pre-planned comparisons between adjusted group means indicated that both the stress inoculation and low fear validation subjects endorsed significantly
fewer negative self-statements at post treatment than did high fear control subjects ($p < .06$ and $< .04$ respectively. Stress education subjects did not differ significantly from either the stress inoculation or high fear controls.

Analysis of covariance results for level of self-efficacy indicated significant intergroup differences between adjusted post treatment means, $F(3, 24)=7.72$, $p < .001$. Pre-planned comparisons between means revealed that all groups had significantly higher levels of self-efficacy than did the group of high fear controls. An analysis of the pre-post differences for self-efficacy level, however, suggested that the ANCOVA results are most likely a function of a reduction in the level of self-efficacy among the high fear control subjects rather than of a uniform improvement among the other groups. An inspection of Table 6 reveals no change in self-efficacy among low fear subjects from pre to post treatment, a 5.49 percent increase among stress education subjects, a 24.74 percent increase among stress inoculation subjects, and a 17.36 percent decrease in self-efficacy among high fear controls.

3. Physiological Measures. Repeated measures analysis of variance (Table 7) revealed that significant reductions in plasma cortisol levels occurred in both the stress inoculation, $F(1, 14)=3.38$, $p < .09$, and the stress education conditions, $F(1, 8)=4.58$, $p < .065$. Subjects in the high fear control and low fear validation groups experienced no comparable change ($F < 1$). Alpha levels below .10 were considered significant because of the unidirectional nature of the
hypotheses (Ley, 1979).

In spite of the rather large reductions in cortisol levels obtained by both treatment groups, the analysis of covariance used to assess inter-group differences at post treatment yielded a nonsignificant main effect for groups, $F(3, 24)=.78$. This finding is not particularly surprising however, in light of the small $R^2$ value associated with the covariance model ($R^2=.12$). This indicates that only a very small percentage of the post test variance was accounted for by the regression model. The poor fit of the model in this case suggests that the data are best understood and interpreted by relying on the pre to post treatment change measures, which, as has been noted, lead to the conclusion that a significant treatment effect existed for both treatment groups. The lack of a significant cortisol reduction for the high fear control group suggests that the observed changes in the treatment conditions were probably not a function of increased familiarity with the assessment environment or a similar effect independent of exposure to treatment.

Additional information regarding the effects of the two intervention procedures on plasma cortisol levels can be obtained by an inspection of individual data. Figure 1 presents cortisol levels for individual subjects, by group. It would appear that at least one subject in each of the four groups experienced a large drop in cortisol levels from pre to post treatment. The superior reduction in mean cortisol levels associated with the treatment groups may be a function of the combination of two factors: the reduced arousal shown
Figure 1. Pre and post-treatment plasma cortisol levels for all experimental subjects

* subject refused to allow post treatment blood sample
by individual subjects, and the failure of any treatment subject to show increased cortisol levels at post treatment. Unlike subjects in the two treatment groups, both the high fear control group, and somewhat surprisingly, the low fear validation sample, contained individuals who showed greater physiological arousal during the post treatment assessment session than they had shown at pre treatment.

4. Approach Behaviors. A repeated measures analysis of variance between pre and post treatment scores on the behavioral avoidance test (BAT) was not significant for any of the four experimental groups (all Fs < 1), indicating that neither of the two intervention procedures resulted in increased approach to stimuli associated with dental treatment.

The analysis of covariance however, in which a one-way ANOVA was conducted on adjusted post treatment scores, yielded a significant main effect for group, F(3, 37) = 3.60, p < .03. Pre-planned comparisons between adjusted group means revealed that the adjusted mean BAT score for the stress inoculation subjects (X̄=8.44) was significantly greater than that of the high fear controls (X̄=7.94, p < .035). The stress education subjects (X̄=8.07) did not differ significantly from either the high fear controls (p < .64) or the stress inoculation subjects (p < .14).

Ten Month Post Treatment Follow-Up

Of the eight stress inoculation subjects contacted 10 months after the completion of treatment, all had undergone a post treatment dental check-up. The average latency from the conclusion of the
Stress inoculation intervention to first dental check-up was 2.7 months. This compares with an average of 32.1 months from the time of the last dental check-up to the pre-treatment assessment. Of the five subjects who required dental treatment after the check-up, four had had at least one treatment session with the dentist. The fifth had a treatment regimen planned, but had not yet started treatment.

One subject whose major pre-treatment complaint involved an inability to tolerate vibration associated with orthodontic treatment had successfully completed the needed procedures at the 10 month follow-up date. One subject who had not visited a dentist for more than 10 years prior to the stress inoculation training program had completed five treatment sessions during which fillings and a root canal procedure had been completed. This individual also reported that he had utilized the coping skills learned in treatment to successfully deal with other stressors in his environment. This report, while highly subjective and unvalidated, is consistent with the concept of stress "inoculation".

Similarly, all of the stress education subjects had also seen a dentist for a check-up 10 months after the conclusion of their program. Average latency to check-up for these subjects was 2.75 months, compared to a 10.2 month interval from the last pre-intervention check-up to the beginning of the stress education program. Of the four subjects contacted, one required no further treatment, one had not begun treatment (although it was needed), and two subjects had successfully completed all needed dental procedures.
Of the five high fear no treatment control subjects contacted at follow-up, three had had no dental check-up or treatment. Of the three subjects who had completed check-ups, two required no treatment. The third had had two treatment appointments for fillings, but she indicated that all treatment had been conducted under general anesthesia while she was unconscious. Table 9 summarizes the results of the 10 month follow-up assessment.
Table 9:
Ten month post-treatment follow-up history of dental checkups and treatment for stress inoculation, stress education, and high fear no treatment subjects.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Check Up</th>
<th>Treatment</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept. 1980</td>
<td>None Required</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nov. 1980</td>
<td>Prepare Crown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dec. 1980</td>
<td>Crown Teeth</td>
</tr>
<tr>
<td>3</td>
<td>June 1980</td>
<td>June 1980</td>
<td>Chipped Tooth Repaired</td>
</tr>
<tr>
<td>4</td>
<td>Feb. 1981</td>
<td>Required, planned,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not Begun</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>June 1980</td>
<td>July 1980</td>
<td>Fillings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aug. 1980</td>
<td>Root Canals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oct. 1980</td>
<td>2 Appointments; New Fillings</td>
</tr>
<tr>
<td>7</td>
<td>Dec. 1980</td>
<td>None Required</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**STRESS EDUCATION**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Check Up</th>
<th>Treatment</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aug. 1980</td>
<td>None Required</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Nov. 1980</td>
<td>None Required</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Feb. 1981</td>
<td>None Required</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Oct. 1980</td>
<td>Required, Not Begun</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Feb. 1981</td>
<td>None Required</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>May 1980</td>
<td>May 1980</td>
<td>2 Appointments for Crown Placement</td>
</tr>
<tr>
<td>8</td>
<td>Nov. 1980</td>
<td>None Required</td>
<td></td>
</tr>
</tbody>
</table>

**HIGH FEAR NO TREATMENT CONTROL**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Check Up</th>
<th>Treatment</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>June 1980</td>
<td>None Required</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dec. 1980</td>
<td>Filling Replaced</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Performed while under General Anesthesia</td>
</tr>
<tr>
<td>3</td>
<td>None</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>Could not</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>contact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>None</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>6</td>
<td>Dec. 1980</td>
<td>None Required</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

Stress inoculation has been suggested as a viable approach to the treatment of anxiety, the management of anger, and the tolerance of pain (Meichenbaum and Turk, 1976). The data base supporting its use however, is composed primarily of experimental results with analogue or non-clinical populations. The current study was designed to determine whether a clinically anxious population, confronting a personally relevant stressor, could benefit from a therapeutic intervention composed of the three components of the stress inoculation treatment package—education, coping skills practice, and rehearsal. Benefit was defined as a reduction in subjective, physiological, and motoric behaviors associated with the stress reaction.

The results revealed that exposure to the stress inoculation treatment package resulted in reduced stress levels as measured by three major categories of behavior: self-report, physiological, and motoric. Subjects exposed to the stress inoculation intervention procedure showed significant pre to post test reductions in self-reported overall fear of dental treatment as well as a significantly greater degree of approach behavior to dental stimuli as compared to the no treatment controls at post treatment assessment. Stress inoculation subjects also subscribed to significantly fewer negative self-statements at post treatment than was the case at pre treatment and reported increased expectations regarding their ability to cope with stressful dental stimuli than did no treatment controls. An additional finding was that physiological arousal, as measured by
plasma cortisol levels, was significantly lower at post treatment than during pre treatment assessment. In fact, post treatment cortisol levels were consistent with those found among the low fear validation subjects, suggesting that changes obtained were clinically as well as statistically significant.

The suggestion by proponents of the stress inoculation treatment approach that the procedure can in fact, provide "inoculation" against other, untrained stressors received some support from the present study. The post treatment measure of trait anxiety (STAI-trait) for stress inoculation subjects was significantly different from that of no treatment controls, suggesting that subjects may have adapted the coping skills training to other stress-producing areas of their lives.

Ten months after treatment, all stress inoculation subjects had seen a dentist for a check-up. Six subjects were found to require dental treatment and all but one had completed some reconstructive dental procedure at follow-up. Of the three subjects who had not seen a dentist in more than two years prior to the study (120, 36, and 30 months), one had had five appointments during which several fillings and a root canal procedure were completed (120 months), one had had a chipped tooth repaired (36 months), and one had had two teeth filled (30 months).

A second question addressed here was whether these stress-related behaviors were affected by the educational component of the treatment package alone, isolated from the components commonly thought of as the
"active ingredients" of stress inoculation—coping skills and rehearsal. The results of several studies have suggested that the process of simply educating a patient about the nature and effects of stress may be enough to reduce arousal associated with stressful stimuli (e.g., Kendall, et al., 1979), while others concluded that the educational component was necessary but not sufficient for increasing tolerance to laboratory-induced pain (Horan, et al., 1977). Predictions of treatment results based on Bandura's self-efficacy theory of behavior change (Bandura, 1977) suggested a differential impact on stress-related behavior by the two treatment modalities, with stress inoculation impacting more such behaviors than stress education.

Results indicated that subjects in the stress education group also showed a significant reduction in cortisol values from pre to post treatment. The mean cortisol level for these subjects was also in the range associated with the low fear validation group, indicating that at post treatment, emotional arousal, as measured by activation of the pituitary-adrenal system, was within normal limits. On the analysis of covariance, however, stress education subjects did not differ from high fear controls on any variable with the exception of self-efficacy measures. An analysis of the raw data suggests that these differences are a function of large decreases in self-efficacy values for high fear controls rather than improvement on the part of the stress education subjects. Of the four stress education subjects contacted at 10 month follow-up, all had seen a dentist for a check-up.
One subject needed no treatment, one needed treatment but had made no plans to initiate it, and two subjects had had teeth repaired. The fact that no subjects in the stress education condition could be classified as total treatment avoiders made it impossible to assess the effects of the education component on avoidance behavior.

Pre-post comparisons on all variables for the high fear no treatment control group showed no significant changes with the exception of improved scores on the Dental Anxiety Scale. This improvement in the control condition is difficult to explain and makes a similar improvement obtained by the stress education subjects uninterpretable. Of the five no treatment control subjects contacted at 10 month follow-up, two had had no contact with a dentist. This included the one individual who could be classified as a dental avoider. Of the three subjects who had a check-up, two reported that no dental work was needed and one subject visited the dentist twice to have two teeth filled. This individual reported however, that the work was completed under general anesthesia and she was unconscious throughout the procedure.

Interpretation of Treatment Results

Based on these data, it would appear that stress-related behaviors can be modified in the desired direction using procedural interventions in a group format. Both the stress inoculation and the stress education intervention groups showed significantly reduced autonomic arousal at post treatment compared to pre treatment values. Only stress inoculation subjects however, were significantly different from
high fear controls in the additional areas of behavioral avoidance, anticipating overall fear rating and trait anxiety. These data raise two major issues with regard to the mechanisms responsible for producing the observed changes in behavior: what is the explanation for 1) the superior results associated with the stress inoculation treatment procedure, and 2) the reduced physiological arousal observed in the stress education group? These questions will be examined from the perspective of two recent theories of behavior change—self-efficacy theory proposed by Bandura (1977), designed to explain psychological changes achieved by different modes of treatment, and Meichenbaum's (1977) cognitive theory of behavior change.

The superior results associated with the stress inoculation treatment procedure are, to a large degree, consistent with predictions generated by Bandura's self-efficacy theory. Self-efficacy theory states that all psychological intervention strategies, to the extent they are successful, alter the individual's level and strength of self-efficacy, or expectation of personal effectiveness. As defined by Bandura (1977), "an efficacy expectation is the conviction that one can successfully execute the behavior required to produce the outcomes (p. 197)". These expectations, and therefore behavior change, are said to be determined by the individual's analysis of four sources of information: performance accomplishments, vicarious experience, verbal persuasion, and physiological states. One prediction generated from this conceptualization of behavior change is that subjects with high and low levels of dental fear would differ with
respect to level and strength of self-efficacy, and presumably, with respect to one or more of the aforementioned factors. A close analysis of the data would appear to support this prediction. For example, at pre treatment there was a large difference between high and low fear subjects on both level and strength of efficacy expectations (of their ability to successfully perform behaviors relevant to obtaining dental treatment). There also appeared to be a difference between high and low fear subjects with regard to the information they utilized in generating efficacy expectations, as can be seen in the following analysis.

First, with regard to performance accomplishments, at pre treatment, all high fear subjects reported dissatisfaction with their history of coping performance when confronted with dental stimuli. They complained of inability to tolerate pain associated with dental procedures, or a fear of loss of control leading to aggression, embarrassment, or avoidance. Second, the difference between high and low fear subjects' ratings of parental attitudes toward dentistry, and the significant positive relationship between self-efficacy measures and mothers' attitudes toward dentistry, suggest a vicarious component to reduced efficacy expectations. Third, subjects' histories with regard to attempts at verbal persuasion related to dental treatment are unknown. To the extent that self-verbalizations affect self-efficacy ratings however (negative self-statements predicted self-efficacy, r=-.60), the high numbers of negative self-statements subscribed to by high fear subjects may be significant. Fourth, high
fear subjects, as a group, experienced significantly more arousal at pre treatment as measured by plasma cortisol levels and self-report indices, than did low fear subjects, possibly providing them with additional evidence of their inability to cope.

A second prediction generated by self-efficacy theory is that intervention strategies that provide the individual with more sources of information on which to base expectations of personal efficacy, will produce the greatest change in self-efficacy, and therefore, behavior. The differential pattern of treatment results associated with the two intervention strategies utilized in the present study are consistent with this prediction. A content analysis of the two treatments indicates that a differential pattern of efficacy information was made available to the two groups of subjects. Stress education subjects for example, were able to utilize only information presented via verbal persuasion in assessing their ability to cope with stressful dental stimuli in the future. Stress inoculation subjects on the other hand, received efficacy information through verbal persuasion and three additional sources: personal accomplishments, vicarious experience, and emotional arousal. An examination of the components of the stress inoculation package reveals that each factor was specifically targeted. Personal accomplishments were provided for during the rehearsal phase of treatment in which subjects using video-simulation of dental procedures, were given an opportunity to test their coping skills and reappraise their reactions to dental stimuli prior to the post treatment assessment session.
Presumably, to the extent they were successful in coping with these weakened stressors, their belief in the effectiveness of the treatment program, and therefore in the utility of their new-found coping skills, was enhanced. This interaction with dental stimuli also provided the vicarious experience of a successful dental visit, adding to the weight of evidence that exposure to dental treatment need not exact a terrible price. Emotional arousal was targeted through the utilization of coping skills such as deep muscle relaxation and specific training in cognitive restructuring. These skills are designed to provide the individual with active behaviors with which to inhibit the physiological changes associated with stress, thereby eliminating one of the primary cues used by individuals in judging their anxiety and vulnerability to stress (Bandura, 1977).

Were it not for the reduction in plasma cortisol evidenced by the stress education group, it would be tempting to attribute the reduced arousal associated with stress inoculation training to the combined effects of deep muscle relaxation and the direct efforts at cognitive restructuring. Because coping skills training was not part of the stress education intervention, however, it could not be considered necessary for the reduced autonomic arousal found in both treatment groups. The plasma cortisol reduction obtained by the stress education subjects requires an alternate explanation. This is not to suggest however, that cognitive restructuring may not have been associated with the reduced arousal obtained with both treatment procedures. There are several lines of research that suggest the
possibility that cognitive changes are a necessary component of either an increase or decrease in plasma cortisol levels (Levine, 1978; Mason, 1968). For example, Levine (1978) states,

In both animals and man there appear to be mechanisms by which organisms process and evaluate stimuli and by which organisms minimize the emotional impact of those stimuli and thus inhibit the normally occurring increased activity of the pituitary-adrenal system (p. 52).

An analysis of the materials presented to the stress education subjects suggests that they may have contributed to "minimizing the emotional impact" (i.e., resulted in a reappraisal of the meaning) of heightened physiological arousal associated with dental stimuli. For example, rather than interpreting increased heart rate, perspiration, and other forms of visceral agitation as evidence of failure, impending pain, and other negative outcomes, stress education subjects may have reappraised their stress reactions along the lines suggested to them during treatment. They were told for example, that their stress reaction was indeed, manageable if it were understood; they were given help in identifying their own physiological reactions to stress, and they were provided with a reconceptualization of their stress experience ("the vicious circle of stress") from which to view and interpret their reactions to dental stimuli. Indeed, according to one prominent cognitive theory of behavior change (Meichenbaum, 1977), it is this reconceptualization process itself
that changes internal dialogue and leads to changes in attentional
and appraisal systems, physiological responses, and the instigation
of new behaviors. According to Meichenbaum,

One goal of the (re) conceptualization process is
for the client to redefine his problems in terms
that will give him a sense of understanding and with
it the feelings of control and hope which are neces-
sary for acts of change (p. 220).

Thus, one explanation for the reduction in autonomic arousal associ-
ated with stress inoculation and stress education is that both treat-
ments provided subjects with information that allowed them to change
their appraisal of the negative visceral arousal they had experienced
when confronting dental stimuli. This arousal was then viewed as
a normal, non-threatening reaction, minimizing the emotional impact,
and therefore, reducing pituitary-adrenal activation.

Finding Associated with Methodology and Assessment

The present study attempted to validate several new measures for
assessing stress in the dental operatory and to obtain new information
about the relationship of these measures to one another. With respect
to issues of measurement, the present study demonstrated the concurrent
validity of behavioral, physiological and subjective measures of stress
as they apply to fearful dental patients, and provided data pertain-
ing to their relationships with one another.

The behavioral avoidance test was successfully adapted for use
in a dental office and proved to be well-suited for assessing approach
behavior in a dental context. Behaviors associated with dental treatment are easily arranged to allow for the presentation of increasingly stressful stimuli to fearful patients, and results indicated that the ability to successfully complete the entire hierarchy of behaviors discriminated high from low fear subjects at pre-treatment. Further evidence for the validity of the behavioral avoidance test as a predictor of stress associated with dental procedures was found in the pattern of correlations between the behavioral avoidance test and the other variables under study. For example, level of approach behavior successfully predicted time since last dental check-up, self-reported fear of dentistry, values for cognitive variables such as negative self-statements and self-efficacy, and levels of pituitary-adrenal activation as measured by plasma cortisol.

The analysis of pre-treatment data provided additional evidence for the validity of plasma cortisol levels as a measure of stress. High fear subjects, as a group, evidenced significantly higher levels of pituitary-adrenal activation than did the low fear subjects. The pattern of correlations with other variables at pretreatment reveals some interesting results as well. As has been discussed, cortisol levels successfully predicted approach behavior to dental stimuli as measured by the behavioral avoidance test. In addition, cortisol values successfully predicted an additional index of dental behavior—months since last dental check-up. Cortisol levels had mixed results with respect to predicting self-reported anxiety. As might be expected, trait anxiety was not related to cortisol
production. On the other hand, cortisol levels significantly predicted values for each specific measure of dental fear—the Dental Anxiety Scale, Dental Fear Survey, and overall fear of dentistry. In addition, there was a significant correlation with measures specifically designed to assess anticipatory fear—the tension/anxiety factor of the Profile of Moods Scale (given to subjects as they waited in the dental office waiting room prior to beginning the behavioral avoidance test), and the "anticipation" factor of the Dental Fear Survey. Especially interesting is the finding that the factor labeled "physiological arousal" on the same survey successfully predicted adrenal-cortical arousal. This suggests that more traditional measures of physiological arousal (perspiration, heart rate, etc.) may co-vary to some degree with adrenal cortical activation. The fact that plasma cortisol levels failed to predict STAI-state anxiety levels, measured immediately prior to the time the blood sample was drawn, is somewhat puzzling. One possible explanation of this finding is that STAI-state levels, assessed at the time each subject sat alone in the dental chair, were influenced by the successful completion of part of the assessment procedure. For example, cognitive dissonance theory would predict that having successfully reached the dental chair, subjects would tend to bring their cognitions into line with their behavior, striving for consistancy between thought and action. In addition, Bandura's theory of self-efficacy (1977) would predict that the individual's feelings of competence would be increased by the information provided to them by virtue of successfully
traversing what was originally perceived as a highly threatening environment ("this isn't as bad as I thought"). It is possible, then, that anxiety had begun to abate by this part of the assessment procedure, with this reduction being reflected in the STAI-state measure.

The failure to find a relationship between plasma cortisol levels and the variables reflecting cognitive processes was also unexpected. Almost all cognitively-based theories of behavior support the idea that emotional arousal is a direct result of the way in which stimuli, or the individual's own ability to cope, are evaluated by that individual. Negative evaluations are said to lead to heightened arousal (Bandura, 1977; Meichenbaum, 1977; Lazarus, 1977). It is possible that the low correlations between plasma cortisol levels and the cognitive variables are a result of a unique characteristic of dental fear—the very real possibility that the initial physiological arousal is classically conditioned. While classical conditioning has been discredited as a primary factor in the etiology of most fear responses (Rachman, 1977), fear of dental procedures is one of the few instances in which most fearful patients have a history of formerly neutral stimuli being paired with a strong unconditioned stimulus—pain. For example, 19 of the 25 high fear subjects reported a past negative dental experience while only one of 11 low fear subjects did so. The low observed correlations may reflect a situation in which high arousal tended to be associated with a classically conditioned phenomenon, rather than generated through cognitive events. Most other stressors that have been linked to cognitive events are of the
social-evaluative type, (e.g., public speaking anxiety) where cognitions might be expected to play a greater role.

Turning to the cognitive variables themselves, the present study was the first to address the issue of the development, validation, and use of a self-statement inventory designed specifically for a population of dental patients. The application of this methodology has been suggested for the study of cognitions (Kendall and Korgeski, 1979) and initial attempts using other populations have proved promising (Cacioppo, Glass, and Merluzzi, 1979; Kendall, Williams, Peachacek, Graham, Shis slak, and Herzoff, 1979). In the present investigation utilizing dental patients, the reported production of negative self-statements concerning dental treatment was a characteristic of high fear subjects that successfully discriminated them from low fear individuals at pre treatment. Interestingly, the presence of positive self-statements in either group failed to do so. This is a direct replication of a finding by Cacioppo and his colleagues (1979) in which heterosexually anxious males were found to have generated significantly more negative self-statements than did non-anxious males in anticipation of a discussion with an unfamiliar woman; positive self-statements did not differentiate the two groups.

Additional information regarding the relationship between negative self-statements and behavior was provided by an examination of the correlational data. While recognizing the limits of these data with regard to cause-effect relationships, it is interesting to note that the negative correlation (-.64) between mother's attitudes toward
dentistry and number of negative self-statements is consistent with the possibility of a vicariously learned component to the etiology of dental fear in adults. This interpretation would be consistent with past research demonstrating a relationship between maternal anxiety and children's fear of dentistry (Johnson and Baldwin, 1968; Johnson and Baldwin, 1969). Further, the high correlations between negative self-statements and self-reported measures specific to dental fear (Dental Anxiety Scale, $r=0.77$), as well as with behavioral avoidance (BAT, $r=-0.38$), are consistent with the view that cognitive processes (e.g., catastrophizing) are associated with fearful behavior. Additional support for this hypothesis is provided by the significant correlations between negative self-statements and the Fear Survey Schedule III ($r=0.60$), in which high scores reflected strong self-reported fear of a large number of environmental stimuli.

As might be expected from the results of previous research, all self-report measures of anxiety successfully discriminated high from low fear subjects at pre treatment. These included anxiety measures specific to dental fear (Dental Fear Survey) and more general measures of state and trait anxiety (STAI).

Conclusions and Recommendations

Perhaps the most clear finding of the current study is that significant reductions in stress-related behaviors can be obtained in a population of fearful dental patients using a group treatment format. In addition, one subject with long standing dental avoidance behavior began dental treatment at the conclusion of his exposure to stress.
inoculation training. Conclusions regarding the relative efficacy of the two treatment procedures must be tentative, however, in spite of the apparent superiority of stress inoculation training with regard to the statistical analysis which utilized an analysis of covariance procedure. As with most research, different methods of viewing the data can lead to different conclusions. For example, in terms of treatment seeking behavior at the 10-month follow-up there was no difference between the two treatment groups—100 percent of both groups saw a dentist within three months of the conclusion of the study. While this study did not focus on a population of dental avoiders, i.e., many of the subjects were regularly undergoing dental treatment before the study began, it is still a meaningful finding. In addition, the apparent superiority of stress inoculation training is less clear when the percentage of improvement for the two groups on each variable if looked at carefully. Such an analysis reveals that stress education subjects outperformed stress inoculation subjects on one-half of the dependent variables utilized in the study. Also, the fact that the two groups had different therapists throughout the course of treatment, is an additional issue that must be considered in drawing conclusions about the relative efficacy of the two treatment conditions. While every effort was made to standardize presentation of material, therapist variables are known to sometimes exert powerful influences on treatment outcome. Finally, the finding that both intervention procedures yielded almost identical reductions in physiological arousal as measured by adrenocortical activation speaks to the
need to be careful with regard to concluding that stress inoculation training is a superior intervention strategy.

Independent of issues of treatment outcome, however, there may be reasons for preferring stress inoculation training over stress education. The most salient of these is the face validity of the procedures involved. At least in this study, subjective reports made at the study's conclusion by a few subjects in the stress education condition indicated that they would have liked some instruction in what to do about stress. The finding that trait anxiety was lower for stress inoculation subjects than for no treatment controls at post treatment also supports the use of the "inoculation" concept involving instruction in coping skills that could have relevance to dealing with other stressors encountered in different contexts.

Explaining obtained results is always difficult, but some interpretation of the obtained pattern of results is possible. For example, the pattern of statistical results regarding the differential effectiveness of the stress inoculation and stress education interventions in changing stress-related behaviors is consistent with cognitive theories of behavior change. Self-efficacy theory predicted the superiority of stress inoculation in changing behavior, based on the preponderance of information this treatment strategy provides to individuals concerning their ability to cope with stress. Meichenbaum's (1977) cognitive theory predicted at least the possibility of reduced physiological cues produced as a result of contact with dental stimuli. There remain some questions however, about the general
relationship between cognitions and arousal. For example, the failure of cognitive measures to correlate with plasma cortisol levels at pretreatment raises one such question. Theoretically, subjects with high levels of negative self-statements and low self-efficacy ratings should have had the highest cortisol levels—a prediction contrary to the findings. One possible explanation of this discrepancy is that cognitions may predict physiological arousal more accurately when the stress reaction is a function of social evaluation—i.e., when arousal is generated by efforts at coping with such stressors as public speaking, heterosocial interaction, test taking, etc. Indeed, most studies on the relationship between cognitions and physiological arousal are based on data obtained in evaluative situations. Stress associated with dental stimuli on the other hand, may have a classically conditioned component. In such a case, negative self-statements need not be related to arousal.

Changing cognitions about the meaning of the conditioned stimuli or the conditioned response (which may acquire properties of a conditioned stimulus in an interactive or cyclical conceptualization of the stress response), could serve to reduce arousal if, as many cognitive theorists believe, classical conditioning in humans is based on the information contained in the conditioned stimulus. Ellis (1979) has come to essentially the same conclusions about reviewing Emmelkamp's data on agoraphobia (Emmelkamp, Kuipers, and Eggeraat, 1978) and has suggested that the only cognitive treatment likely to affect physiological responding when such responding is the cue for even
greater arousal, is helping the individual to reappraise the meaning of the visceral arousal itself. The present study then, offers some empirical support for this formulation and extends the use of the stress inoculation treatment package to areas other than social-evaluative stressors.

Methodologically, the present study has provided additional tools for the study of stress. The dental office has been shown to be a useful environment in which to study stress and a realistic alternative to the use of analogue stressors. In addition, several familiar behavioral measures have been successfully adapted to the dental operatory and validated as indices of stress, as were two cognitive assessment techniques: the self-statement inventory and self-efficacy rating. Finally, a physiological measure that has been known for some time, but ignored by many psychologists studying stress and anxiety, has been shown to correlate with both behavioral and self-report indices of stress. Plasma cortisol would appear to offer a great deal of promise as a dependent variable in both the measurement and treatment of stress, especially in light of the success in the present study of manipulating cortisol levels through psychological intervention, the first time this has been attempted.

Of course there were many questions raised by the present research which must be addressed if progress in the assessment and treatment of stress-related behaviors is to continue. First, a great deal more needs to be learned about the effective components of the stress inoculation treatment package, especially with regard to the specific
effects of each component on behavior. In addition, the distinction between social-evaluative and conditioned stressors deserves further investigation, and the question of a possible differential response to each type, pursued.

Second, if fearful dental patients are to continue to be used as subjects in stress experiments, a more sophisticated system of classifying subjects needs to be developed in order to avoid the pitfalls associated with the "uniformity myth", first described by Kiesler (1966) and now well known. In the present investigation, for example, there appeared to be a sub-grouping of subjects whose primary difficulty appeared to focus around social-evaluative anxiety (e.g., lack of assertiveness, fear of loss of control, etc.). A preliminary attempt at assessing the relationship between unassertive behavior in the dental context and "dental fear" has yielded promising results.

Finally, from a practical point of view, the relationship between cost and benefit of treatment should be considered in designing and evaluating intervention programs designed to help individuals cope with stress. The present study for example, has demonstrated that a format utilizing group instruction can be effective in reducing stress-related behaviors. The stress inoculation intervention required an average of only 50 minutes of therapist time per patient. From a cost-benefit perspective, this is a vast improvement over previous attempts at treating this patient population.
Reference Notes


-100-
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APPENDIX A

HUMAN SUBJECTS COMMITTEE APPROVAL (1)

STATEMENT OF INFORMED CONSENT (2)

CONSENT FOR RELEASE OF CONFIDENTIAL INFORMATION (3)

PERSONAL INFORMATION FORM (4)
January 15, 1980

Mr. C. Perry Bosmajian, Jr.
Psychology Department
Campus

Dear Mr. Bosmajian:

Your research entitled "The Assessment and Treatment of Dental Fear" was approved by the Institutional Review Board for Research Involving Human Subjects at the January 9, 1980 meeting.

If additional information is needed, please do not hesitate to contact me.

Yours truly,

[Signature]

Chairman
Institutional Review Board
for Research Involving Human Subjects

cc:
STATEMENT OF INFORMED CONSENT (2)
Virginia Tech

Name ___________________________ Date ______________________

1. I agree to participate in a research study entitled "The Assessment and Treatment of Dental Fear". I understand that the purpose of this study is to determine the effectiveness of psychologically oriented treatments in the reduction or elimination of fear associated with dental treatment.

2. I understand that I will be asked to attend five group meetings, each lasting sixty to ninety minutes, and spaced at one week intervals. I understand and agree that any information that I divulge about myself or that is told to me by others in the course of these meetings will be kept confidential.

3. I understand that I will be asked to schedule and attend two assessment sessions, one prior to and one after the treatment sequence. These assessments will be conducted at a dentist's office. As part of this assessment procedure, I understand that I will be asked to allow a small blood sample to be taken from my arm by a licensed physician. I also understand that I will be asked to complete several questionnaires related to my fear of dental treatment.

4. I acknowledge that the experimenter has informed me that the following steps will be taken to ensure confidentiality: 1) my responses will be treated as confidential information; 2) I will be identified by number only in all analyses, and 3) data will be used only in aggregate analyses and no individuals will be identified.

5. I understand that no guarantee of successful treatment for my fear of dental treatment has been made to me. I also understand however, that I will be offered the opportunity to participate in that treatment which is found to be the most successful in reducing or eliminating fear of dental treatment.

6. I understand that my participation in this project is voluntary and that I may withdraw or decline to participate at any time.

Signature ___________________________ Phone ______________________

Address ______________________________

If after participating in this project you have any concerns regarding this research you may contact one of the persons named below or the Institutional Review Board at Virginia Tech.

Experimenter: Perry Basmajian, Psychology Department
Sponsor: Dr. Richard Eisler, Psychology Department
Consent for Release of Confidential Information (3)
Virginia Tech Dental Fear Project

I, ________________________________, hereby give my written consent to have ____________________________ at ________________________________ release all information pertaining to my (1) schedule of dental appointments and (2) dental treatment to Perry Bosmajian or a representative of the Dental Fear Project, Virginia Tech Psychology Department, Virginia Tech, Blacksburg, VA 24060.

I further release all parties stated herewithin from any legal liability resulting from the release of this information, with the understanding that all parties involved will exercise sufficient safeguards while using this information.

(Signed) ___________________________ Address ___________________________
(Patient)

(Signed) ___________________________ Address ___________________________
(Witness)
DENTAL FEAR PROJECT
Personal Information Form (4)

Name ___________________________ Date ________________

Home Address: ____________________________ Street ____________ Town ____________ State ____________ Zip ____________

Home Telephone ____________________________ Business Telephone __________________

Sex M F (Circle one) Age ____________

1. What is the name of your present dentist? __________________________________________

2. In what town or city does he/she practice? __________________________________________

3. How long has it been since you last visited a dentist for:
   a) check up/ cleaning ______________
   b) dental treatment ______________

4. Are you currently avoiding a dental check up or needed dental treatment because of fear of the procedure? Yes No (Circle one)

5. What was your mother's attitude toward dentistry or dental treatment?

   Very Fearful or Negative 1 2 3 4 5 6 7 or
   Very Relaxed or Positive

6. What was your father's attitude toward dentistry or dental treatment?

   Very Fearful or Negative 1 2 3 4 5 6 7 or
   Very Relaxed or Positive

7. Have you had a very negative, upsetting, or painful experience with dental treatment? YES NO (circle one)

   If YES, please describe: __________________________________________________________

   ____________________________________________________________
   ____________________________________________________________

8. Do you believe that your current fear of dental treatment is a result of an early negative experience? YES NO (circle one).
9. What goals do you hope to meet by participating in this program?
   1. ____________________________________________________________
   2. ____________________________________________________________

10. How helpful do you expect this program to be in meeting your first goal?
   1  2  3  4  5  6  7  (circle one)
      Extremely Helpful
      Not Sure
      Not at all Helpful

11. In meeting your second goal?
   1  2  3  4  5  6  7
      Extremely Helpful
      Not Sure
      Not at all Helpful

12. What goes through your mind while you are sitting in the dentist's chair waiting for him to begin work?
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

13. Is fear of pain the primary reason why you are made anxious by dental treatment?
    YES  NO  (circle one)
    If NO, what is the primary reason? ____________________________________
APPENDIX B

ASSESSMENT PROCEDURE (5)

DENTAL FEAR SURVEY (6)

DENTAL SELF-STATEMENT INVENTORY (7)

DENTAL SELF-EFFICACY SCALE (8)

BEHAVIORAL AVOIDANCE TEST (9)

CORTISOL RIA PROTOCOL (10)
ASSESSMENT PROCEDURE (5)

1. When subjects arrive, they will be seated in the waiting room by one of the Experimenters. Each will be given the Profile of Mood Scale and the STAI-Trait Scale to complete while they are waiting.

2. Prior to actually going into the operatory, they will be taken to an interim waiting area. They will be left alone for two minutes. They will then be asked to complete the Self-Statement Report Form.

3. After the completion of the Self-Statement Report Form, while they are still in the interim waiting area, the Behavioral Avoidance Test will be explained as follows:

   "We are interested in how many dental related behaviors you are capable of performing. You will be asked to perform a series of behaviors, one after the next. Prior to any behavior you may decline to perform that behavior. Simply indicate that you do not wish to continue."

4. After the subject has been seated in the dental chair they are to be left alone in the operatory for three minutes. During this time they are to complete the STAI-State scale. At the conclusion of the three minute period, or when they have finished the scale, signal the medical technician to come in and take the blood sample while the subject remains seated in the dental chair.

5. At the conclusion of the Behavioral Avoidance Test thank the subjects for their participation and dismiss them.
The Dental Fear Survey (6)

The items in this questionnaire refer to various situations, feelings, and reactions related to dental work. Please rate your feeling or reaction on those items by circling the number (1, 2, 3, 4, or 5) of the category which most closely corresponds to your reaction.

1. Has fear of dental work ever caused you to put off making an appointment?

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2. Has fear of dental work ever caused you to cancel or not appear for an appointment?

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When having dental work done:

3. My muscles become tense...

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4. My breathing rate increases...

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5. I perspire...

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6. I feel nauseated and sick to my stomach...

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7. My heart beats faster...

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For Research Purposes ONLY.
Following is a list of things, and situations that many people mention as being somewhat anxiety or fear producing. Please rate how much fear, anxiety, or unpleasantness each of them causes you. Use the numbers 1-5, from the following scale. Make a check in the appropriate space. (If it helps, try to imagine yourself in each of these situations and describe what your common reaction is.)

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<td>Making an appointment for dentistry ..........</td>
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<td>9</td>
<td>Approaching the dentist's office ............</td>
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<td>Sitting in the waiting room .................</td>
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<td>11</td>
<td>Being seated in the dental chair ............</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>The smell of the dentist's office ...........</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Seeing the dentist walk in ...................</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Seeing the anesthetic needle .................</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Feeling the needle injected ..................</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Seeing the drill .............................</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Hearing the drill ............................</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Feeling the vibrations of the drill ..........</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Having your teeth cleaned ....................</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>All things considered, how fearful are you of having dental work done .............</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

-122-
DENTAL SELF-STATEMENT INVENTORY (7)

Listed below are several statements that people make to themselves (their thoughts) during dental treatment. Please read each self-statement and indicate how frequently these self-statements characterized your thoughts during dental treatment. Please read each item carefully and then circle the appropriate number as it relates to your thoughts.

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
<th>Hardly Ever</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>My dentist has such a gentle touch.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>I'm having to keep my mouth open too long.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>I wonder if this work really needs to be done.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>This chair is really comfortable.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>I don't think he'll ever get his hands out of my mouth.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>He really has a nice personality.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>I like the music that is playing in the office.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>I wonder if he's doing as good a job as he could.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>He looks like he has all the latest equipment.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>I really don't like the smell of the office.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>I hope the needle doesn't break off in my mouth.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>I'm really glad I came in and got this done.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>This isn't nearly as bad as I thought it would be.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>This guy really seems to know what he's doing.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>It was a mistake for me to come in here.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>I like the way he tells me what he's doing.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17</td>
<td>I hope this won't hurt.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>He has decorated the room very nicely.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19</td>
<td>Those tools look like they could really hurt if they slipped.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>It sure is hard to breathe.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Dental Self-Efficacy Scale (8)

Indicate which of the following behaviors you expect that you could perform if you were asked to do so at this time by checking "YES". If you do not expect that you could perform a particular behavior at this time, check "NO".

For each of the behaviors below that you checked "YES", indicate the strength of the probability that you could actually perform the behavior if you were asked to do so at this time using the following scale:

<table>
<thead>
<tr>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>virtually impossible</td>
<td>fairly improbable</td>
<td>fairly probable</td>
<td>completely certain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Telephone the dentist's office and make an appointment for a check-up.  
   Yes____ No____. PROBABILITY RATING____.

2. Sit in the waiting room of a dentist's office for 15 minutes while dental work is performed on other patients.  
   Yes____ No____ PROBABILITY RATING____.

3. Sit in a dental chair for 20 minutes in the room with the drill and other instruments present.  
   Yes____ No____ PROBABILITY RATING____.

4. Allow the dentist to take X-rays of your mouth and teeth.  
   Yes____ No____ PROBABILITY RATING____.

5. Allow the dentist to clean your teeth using hand instruments (e.g. pick, scraper).  
   Yes____ No____ PROBABILITY RATING____.

6. Allow the dentist to clean your teeth using polishing paste and a cleaning wheel attached to the drill.  
   Yes____ No____ PROBABILITY RATING____.

7. Allow the dentist to examine your teeth for cavities using hand instruments.  
   Yes____ No____ PROBABILITY RATING____.

8. Allow the dentist to use hand instruments to prepare a tooth with a cavity to be filled.  
   Yes____ No____ PROBABILITY RATING____.

9. Allow the dentist to drill on a tooth in order to prepare it to be filled.  
   Yes____ No____ PROBABILITY RATING____.

10. Allow the dentist to inject anesthetic to numb part of your mouth.  
    Yes____ No____ PROBABILITY RATING____.
BEHAVIORAL AVOIDANCE TEST (9)

<table>
<thead>
<tr>
<th>Code Number</th>
<th>Date</th>
<th>Subject</th>
<th>Dentist</th>
<th>Rater</th>
</tr>
</thead>
</table>

INSTRUCTIONS TO RATER: Prior to each behavior make the following statement:
"The next step is _____. Can you perform this step?"

<table>
<thead>
<tr>
<th>Circle one</th>
<th>1. Sit in Waiting Room (5 minutes)</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Walk into Operatory</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>3. Get into Chair</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>4. Allow bib to be put on</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>5. Sit in chair (3 minutes)</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

***Take Blood Sample***

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Time from entrance to completion</th>
</tr>
</thead>
</table>

*Comments about venapuncture:

<table>
<thead>
<tr>
<th>6. Open mouth and allow dentist to examine mouth using a mirror (30 seconds)</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Allow dentist to scrape teeth with instrument (1 minute)</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>8. Allow dentist to use drill with polishing burr (1 minute)</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>9. Allow dentist to perform injection.</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

*** Give STAI-State scale prior to blood sample while subject remains in the chair.

*Comments should include, but are not limited to the following: several attempts to find vein, fainting, subject comments and behavior, etc.
CORTISOL RIA PROTOCOL (10)

ENDOCRINE SCIENCES

TARZANA, CALIFORNIA 91356

PLASMA CORTISOL
RADIOMMUNOASSAY PROCEDURE

ANTISERUM No. F21-53

November 1972
ENDOCRINE SCIENCES antisem No. F21-53 is a specific and sensitive antisem developed for the measurement of cortisol. The antisem can be used in a radioimmunossay procedure to measure cortisol directly in plasma. This direct simple method is superior to previously used fluorimetric and competitive protein binding methods because of its higher sensitivity and specificity. Greater accuracy and precision are achieved due to the elimination of errors associated with extraction and other purification processes. The reliability and sensitivity of the method make it especially useful for the evaluation of adrenal suppression tests.

In this bulletin a complete direct radioimmunoassay for plasma cortisol is described. Part I contains technical information on antisem F21-53. Part II contains an immunossay procedure using this reagent. Part III contains instructions for the preparation of plasma for the immunossay.

The development of a specific radioimmunoassay for cortisol has provided a greatly simplified procedure for measuring this steroid. However, laboratories having limited experience with sensitive protein binding assays may encounter difficulties in their initial attempts to set up the procedure. The primary reasons for these problems are inadequate precaution and cleanliness in the performance of the procedure, this results in binding interference ("blanks") from substances contained in and on the reagents and materials used for the assay. Part IV of this bulletin contains information on the sources and elimination of common interference problems in steroid radioimmunoassays. We strongly recommend that the suggestions given in this section be carefully considered before the assay procedure is attempted.

PART I - TECHNICAL INFORMATION

Sensitivity -

Standard curve normally obtained with Endocrine Sciences antisem F21-53 at a dilution of 1/2500 is plotted in Figure 1. The range and sensitivity were selected to allow the measurement of plasma cortisol concentrations from 1 to 40 ug/100 ml using sample volume of 50 ul of 1/10 diluted plasma. Since the antisem has been used primarily for measuring plasma cortisol, it has not been diluted to determine maximum sensitivity. The range can easily be adjusted to meet individual requirements by reasing or decreasing the dilution of the antisem.
SPECIFICITY

Data on the cross-reaction of the antiserum is presented in Table I. Cross-reactions were determined by direct incubation with the antibody and 1,2-\(^3\text{H}\)-cortisol. The results are expressed as percent cross-reaction at a level of 50% bound. Of those compounds tested only corticosterone cross-reacts strongly with the antibody. This cross-reaction is common in antisera developed against cortisol conjugated at C-21. The effect of this cross-reaction in human plasma is reduced due to the low concentration of corticosterone relative to cortisol. In other animals with relatively high levels of corticosterone, this cross-reaction will interfere with the measurement of cortisol and a separation step is necessary to achieve specific results.

The results obtained using the antiserum in a direct method are not significantly different from those obtained after purification of the plasma sample by either extraction or paper chromatography (Table II).
### TABLE I

**Steroid Cross-Reaction With Antiserum F21-53**

<table>
<thead>
<tr>
<th>Compound</th>
<th>% Cross Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corticosterone</td>
<td>89.0</td>
</tr>
<tr>
<td>20β-Hydroxyprogesterone</td>
<td>3.7</td>
</tr>
<tr>
<td>Progesterone</td>
<td>2.0</td>
</tr>
<tr>
<td>17-Hydroxyprogesterone</td>
<td>1.8</td>
</tr>
<tr>
<td>20α-Hydroxyprogesterone</td>
<td>1.8</td>
</tr>
<tr>
<td>Deoxycorticisol</td>
<td>1.8</td>
</tr>
<tr>
<td>Aldosterone</td>
<td>1.6</td>
</tr>
<tr>
<td>Deoxycorticosterone</td>
<td>1.5</td>
</tr>
<tr>
<td>Cortisone</td>
<td>0.8</td>
</tr>
<tr>
<td>Testosterone</td>
<td>1.3</td>
</tr>
<tr>
<td>Estradiol</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Estriol</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Pregnanediol</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Pregnanetriol</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Tetrahydrocortisone</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Tetrahydrocortisol</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Tetrahydrodesoxycortisol</td>
<td>&lt; 0.1</td>
</tr>
</tbody>
</table>

### TABLE II

**Constancy of Plasma Cortisol Levels After Purification (μg/100 mL)**

<table>
<thead>
<tr>
<th>Direct Plasma</th>
<th>Solvent Extraction</th>
<th>Paper Chromatography</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1.4</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>1.1</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>11.0</td>
<td>10.5</td>
<td>10.9</td>
</tr>
<tr>
<td>13.4</td>
<td>14.1</td>
<td>14.3</td>
</tr>
<tr>
<td>9.6</td>
<td>10.9</td>
<td>11.0</td>
</tr>
<tr>
<td>3.7</td>
<td>2.4</td>
<td>1.1</td>
</tr>
<tr>
<td>17.0</td>
<td>17.4</td>
<td>18.1</td>
</tr>
<tr>
<td>29.0</td>
<td>28.0</td>
<td>--</td>
</tr>
<tr>
<td>27.0</td>
<td>25.7</td>
<td>25.3</td>
</tr>
<tr>
<td>25.0</td>
<td>28.1</td>
<td>29.0</td>
</tr>
<tr>
<td>35.8</td>
<td>31.4</td>
<td>34.2</td>
</tr>
</tbody>
</table>
**Radioimmunoassay Procedures**

The data in Tables I and II show that antiserum F21-53 may be used to measure cortisol directly in human plasma. Interference due to corticosterone is less than that found in commonly-used protein binding and fluorimetric methods. In addition, the interference due to other compounds commonly measured by these methods is eliminated in the radioimmunoassay. In samples containing high levels of corticosterone, interference may be reduced or eliminated by employing selective solvent extraction.

The direct method recommended by Endocrine Sciences (1) has been thoroughly tested. The normal levels obtained with this procedure are slightly lower than those reported for fluorimetric and protein binding methods, reflecting the increased specificity of the radioimmunoassay.

**Stability**

The stock serum is diluted 1/20 with 0.05M borate buffer, pH 8.0, and freeze-dried before shipping. It may be reconstituted to a dilution of 1/20 by adding the volume of distilled H2O indicated on the label of each vial. At this dilution the antiserum is quite stable if stored at -10°C. It may be repeatedly thawed provided it is returned to the freezer immediately after each use.
1. **Borate Buffer, 0.05M, pH 8.0** - Dissolve 2g of reagent grade boric acid crystals in 500 mL of distilled water containing 0.40 mL of 10N NaOH. Confirm pH with short range paper or with a pH meter. Neither the pH or concentration is critical. Primary attention should be given to the cleanliness of the glassware.

2. **Human Gamma Globulin (Parke-Davis Immuno-G 165 solution).**

3. **Stock 1,2-3H-Cortisol (New England Nuclear No. NET-185)** - Dilute 250 uc to 10 mL with redistilled methanol. Store at 4°C.

4. **Cortisol Standards - Prepare stock standards of 1 ug/mL and 100 ng/mL in redistilled ethanol.** Prepare working standards of 125, 250, 500, 750 pg/0.1 mL and 1, 1.5, 2, 10 ng/0.1 mL in redistilled methanol from the stock solution. Store at 4°C. All pipets, volumetric flasks, or other glassware used for preparing the standards should be rinsed thoroughly with methanol before use.

5. **Ammonium Sulfate - Prepare a saturated solution of reagent grade salt in distilled water (confirm by excess of crystals).**

6. **Scintillation Fluid - Dissolve 20g of PPO in 1 liters of toluene containing 2.7 methanol.** This reagent is recommended only for newer scintillation counters equipped with bi-alkaline photomultiplier tubes.

7. **Assay Tubes - 2 mL conical tubes (Kimax No. 45130) are recommended for the assay.** Clean tubes as described in Part IV. Before using, wash the tubes twice with methanol by mixing the solvent in the tubes on a vortex mixer. Discard and shake out the solvent between washes. Allow the tubes to dry.

8. **Stock Antiserum - Reconstitute the stock antiserum with the volume of distilled water indicated on the label of each vial.** Store at -10°C. Refreeze immediately after each use.

9. **Dilute Antiserum - Prepare dilute antiserum fresh for each assay by adding these reagents in the following order:**

   a) 12 mL borate buffer.
   b) 1,200,000 dpm of 1,2-3H-cortisol (about 10 ul of stock solution), mix well.
   c) 70 ul of human gamma globulin, mix well.
   d) 100 ul of gently but well mixed stock antiserum, mix the solution thoroughly but gently. Centrifuge for five minutes at 2000 rpm before use.
INCUBATION WITH THE ANTIBODY

Prepare a standard curve by adding standards containing 0, 125, 250, 500, 750 pg, and 1, 1.5, and 2 ng of cortisol to methanol-rinsed clinical tubes. Transfer the tubes to a 50 ml glass beaker containing approximately 20 ml of water. Evaporate the solvent to dryness in a vacuum oven at 45°C and a pressure setting of 25. Refer to Part IV for alternative methods of drying samples.

Add 0.05 ml of borate buffer containing 10% methanol to each tube. Add 0.20 ml of dilute antiserum to each assay tube and to three counting vials. Cover the tubes with parafilm and mix several times on a vortex mixer to dissolve the dried samples. It is essential that the samples be mixed well; however, foaming should be avoided by setting the vortex at a medium speed and tilting the tubes until they are nearly horizontal. Incubate the samples for three hours at room temperature.

SEPARATION OF FREE AND BOUND SPECIES -

Add 0.25 ml of saturated (NH₄)₂SO₄ to each tube. Mix the contents thoroughly on a vortex mixer. Excess foaming should again be avoided by mixing at a medium speed.

Cover the tubes with parafilm and centrifuge them for ten minutes at 3000 rpm at room temperature. Carefully transfer 0.40 ml of the supernatant to counting vials using a Schuette/Mann biopipet (No. 0010-20) or similar pipetting device is recommended for this purpose. If one is not available, the supernatant should be transferred to another tube with a Pasteur pipet and a quantitative aliquot then transferred to a vial using a pipet.

SCINTILLATION COUNTING -

To counting vials containing direct aliquots of the dilute antiserum, add 0.25 ml of saturated (NH₄)₂SO₄.

Add 10 ml of scintillation fluid to all of the vials, cap them tightly, and shake for five minutes on a mechanical shaker. Allow the vials to settle by placing them in the counter for several minutes before counting. Stabilizers may be used instead of direct extraction into the scintillation fluid. However, they are expensive, decrease counting efficiency, and are unnecessary for this purpose.

NON-SPECIFIC BINDING -

Cortisol may exhibit considerable non-specific binding in the 10% saturated ammonium sulfate solution. Both sticking to the glass and binding to the carrier protein HGG have been demonstrated. Human gamma globulin has been added to remove all the mass of the precipitate. Binding to proteins contained in the HGG may vary from batch to
Part II

7

Batch and from assay to assay, it should be checked by incubating 1,2-3H-cortisol in buffer containing HGG without antiserum, as described above. In the absence of antibody, the percent bound label should be greater than 90%. If this result is not obtained, either preparations of HGG should be investigated. Non-specific binding problems should be resolved before a standard curve is attempted. Non-specific binding should be determined for both standards and plasma samples with each assay.

Calculations

Standard curves are constructed by plotting the percent of unbound 1,2-3H-cortisol as a function of unlabeled cortisol content. The percent unbound = (x/0.8 yz)(100)

where x = CPM in 0.40 ml of supernatant, y = the total CPM added to the tube, and z = (percent unbound label in non-specific binding)/100.
PART III - PROCEDURE FOR PREPARATION OF PLASMA SAMPLES

REAGENTS AND GLASSWARE -

1. Methanol (reagent grade) - Redistill and store in a glass-stoppered flask.

2. Sample Tubes (Corning disposable test tubes 12 x 75 mm) - Rinse with water and once with methanol. Then allow them to dry.

3. Borate Buffer/Methanol, 11% - Prepare by adding 11 ml of redistilled methanol to 89 ml of borate buffer 0.05M, pH 8.0.

PREPARATION OF SAMPLES -

1. Pipet 0.10 ml of well mixed plasma to a sample tube. Add 0.90 ml of borate buffer/methanol, 11%, cap the tubes with parafilm, and mix the contents well on a vortex mixer. Heat the samples at 60°C for thirty minutes. (2) Pipet 0.05 ml of the dilute plasma to duplicate assay tubes. Pipet two representative samples in duplicate to assay tubes to check non-specific binding. Assay the samples and non-specific binding samples as described in Part II.

CALCULATIONS -

The non-specific binding should not vary much from sample to sample. An average of two or three samples may be used to calculate all of the results. Non-specific binding for samples will be higher than for standards due to human plasma proteins.

\[
\text{The percent free for standards and samples} = \frac{X}{0.8(y/z)} \times 100
\]

where \(X = \text{dpm in 0.40 ml of supernatant after (NH}_4)_2\text{SO}_4 \text{ precipitation,}
\]

\(Y = \text{dpm in 0.20 ml of dilute antiserum,}
\]

\(Z = \text{appropriate unbound fraction from non-specific binding check (NSB),}
\]

\(Z = \frac{X(\text{NSB})}{0.8(y)}\)

Read the cortisol content from the curve.

100 ml : pg read off standard curve \(\times 0.02\)
NORMAL LEVELS

The normal levels obtained with the procedure are:

<table>
<thead>
<tr>
<th>Time</th>
<th>Range</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 AM</td>
<td>8 - 18 µg/100 mL</td>
<td>11.0</td>
</tr>
<tr>
<td>4 PM</td>
<td>4 - 10 µg/100 mL</td>
<td>6.9</td>
</tr>
</tbody>
</table>

TECHNICAL ASSISTANCE

Technical assistance is available at Endocrine Sciences for customers who encounter difficulties with the assay procedure. We recommend that you contact us if you are unable to reproduce our results or encounter problems which can more readily be solved by discussing them with our experienced personnel.

REFERENCES

1) Chandler, D.W., Seegan, G.W., Mayes, D.M. (Submitted for publication)

APPENDIX C

TREATMENT MANUAL: STRESS INOCULATION (11)

TREATMENT MANUAL: STRESS EDUCATION (12)
INTRODUCTION

Those of us associated with the Dental Fear Project would like to welcome you. Each of you have become involved in this Project because you have one thing in common - a fear of dental treatment. Some of you have totally avoided any contact with the dentist for quite some time. Others have been able to have some dental work performed, but have found it to be a highly unpleasant experience. The fact that you are now involved with others who share this fear is a first step in overcoming it. Up to this point you may have felt that you were almost alone in fearing dental treatment. The fact is that more than 10 million people in this country avoid dental work because of fear. You have lots of company.

The purpose of this manual is to provide you with a summary of what will be presented during each treatment session. This will free you from taking notes and allow you to fully concentrate on the material being presented. You are encouraged to review the information that is presented here between sessions. This information can guide you in developing skills to cope with the stress associated with dental treatment. But changes in the way you cope with this stress will depend on your willingness to practice the behaviors that you will be introduced to. Your attendance at each session is necessary if you are to fully benefit from the Program.
Fear of Dental Treatment

Why are so many people afraid of modern dentistry, which in most cases, is relatively painless? There is no clear-cut answer to this question. Many people have had one or more negative experiences with dental treatment in the past. Often this may have involved experiencing extreme pain during a dental procedure. Others have had to deal with dentists who were rough or treated them in a callous or rude manner. Still other fearful individuals have learned to fear dental treatment because of "horror stories" they've heard from others, perhaps parents, family members, or friends. What is clear about dental fear, however, is that in each case, it has been learned.

Why Can't I Seem to Get Over It?

Just as each of you has somehow learned to fear dental treatment, the ability to overcome this fear will depend upon your ability to learn skills to cope with it. Unfortunately, to this point, you've never had the chance. Typically, the fearful individual never has the opportunity to learn that dental treatment need not be a negative, scary, or painful experience.

Suppose you have been avoiding dental treatment for a long time, for example. You develop a tooth ache or gum disease because of failure to have needed dental work performed. Eventually, a trip to the dentist becomes necessary. You arrive for your appointment and the following things happen:

1. The dentist scolds you for allowing your mouth to get into such awful shape. What's worse, you know he's right.
2. The procedure, because of its nature as a dental emergency, coupled with a lack of past care, is lengthy and painful.
3. The high level of anxiety that you feel makes the pain even worse (anxiety almost always increases the experience of pain).
4. You've been humiliated and hurt. The overall experience is so negative that you swear you'll never go to the dentist again— and you don't— until the next time an emergency arises, and . . .
5. the entire procedure repeats itself.

Under these circumstances, it is not surprising that you tend to avoid the dentist.
A Second Example

Let's take a less extreme example. You can go to the dentist to have needed work done, but it's a very, very uncomfortable experience. You begin dreading your upcoming appointment. By the time you are sitting in the dental chair (assuming you haven't cancelled your appointment), your muscles are very tight. Your heart is racing. The smell of the office is unpleasant and reminds you of how bad it was last time. The instruments look very threatening. You find that your hands are wet and cold and your breathing is shallow. The dentist begins picking at your teeth with one of his instruments. By this time even the slightest pressure or pain is enough to send you through the roof. Your anxiety makes what little discomfort there is turn into excruciating pain. You feel completely out of control and helpless. You may be afraid that the dentist will notice how scared and tense you are (he will), and that he'll think you're crazy (he won't, but you do). You're afraid you'll embarrass yourself.

What has just been described is a stress reaction.
The Vicious Circle of Stress

It should be clear by now why it is so difficult to overcome your fear of dental treatment. We have diagramed the stress cycle below.

First, look at Box 1, "Physiological Arousal". Here, your past associations cause your heart to beat faster and your hands to get cold. Your body starts to produce adrenaline.

Next, at Point 2, "Automatic Appraisal of Situation as Anxiety", you interpret this feeling in your body as one giant panic reaction. You feel completely out of control.

At Point 3 you become angry and annoyed at yourself for handling the situation so poorly. You figure there must be something wrong with you and you know that the next visit to the dentist will also be a terrible experience.

Point 2 and Point 3 combine to cause even greater physiological arousal (Box 1) and the whole cycle starts over, only this time it's a little worse. A few times around this circle and you've really got yourself worked up!
Understanding Stress

Stress is a reaction to either a physical or psychological threat. In either case, it is the same reaction. That is, the stress reaction that is generated by your body to help you deal effectively (cope) with real physical danger (for example, being robbed at gun-point) is the same reaction that occurs when you are confronted with a psychological threat. When a physical threat is involved, your body's reaction makes sense. By increasing the level of adrenaline in your blood and causing your heart to race faster, you are being prepared to either fight the threat, or run away from it.

Psychological stress on the other hand requires no such arousal. As a matter of fact, such arousal can interfere with your ability to cope (Have you ever forgotten what you wanted to say because you were nervous?). Most psychological stress is highly personalized. That is, what may seem like a threat to some people may not to others. For example, not every one is stressed by speaking in public (or going to the dentist), while others simply cannot do it at all.

Identifying Stress

Before you can learn to manage stress, you must first learn to identify it. The stress reaction is not one, overwhelming, panic attack, although it may seem that way while you are sitting in the dentist's office. Stress can be divided into two components:

1. physical signs of stress (your body's reactions)
2. cognitive signs of stress (your thought processes)

We will now begin to break the stress reaction down into its several parts. You will see that your reaction to the dentist's office is not as all-powerful as it might seem at first. It is really made up of many small reactions, each of which can be controlled. We will now take a closer look at the physical and cognitive signs of stress.

Physical Signs of Stress

People who are highly anxious during dental treatment are often scared by the reactions of their own bodies while dental procedures are being performed. They may think that the feelings they are experiencing (racing heart, etc.) mean that there is something seriously wrong with them. They may believe they are having a heart attack or a nervous breakdown. They may believe they are going "crazy" for having such a strong response to a procedure they know is not only harmless, but necessary for the maintenance of good overall health. None of this is true. While it may be an unpleasant feeling, it is not dangerous. It does not mean that there is something wrong with you, either physically or mentally.
The body tends to respond to stress in an automatic way, although not everyone reacts in exactly the same manner. The following are some of the more frequent physical signs of stress:

1. faster and more shallow breathing
2. increased heart rate
3. changes in blood flow - constriction of vessels in the hands and feet. (This is why your hands get cold).
4. increased muscle tension or tightness
5. increased perspiration or sweating
6. changes in blood chemistry (for example, more adrenaline).
7. muscle tremor or shaking or tremor

Viewed this way, the anxiety you feel while you anticipate or actually undergo dental treatment, what we have called the stress reaction, need not be overwhelming. It is made up of many small parts, each of which can be overcome. It is important that you understand this, because the way you interpret, or view, the stress reaction that you feel while sitting in the dentist's chair will, to a large extent, determine how severe it will be.

This brings us to the role of cognitive factors in the stress reaction.
Cognitive Factors in Stress

Up to this point we have focused primarily on the body's reaction to a stressful situation, which we have labeled "physical signs of stress". However, there is another thing that probably goes on when you're feeling stressed while in the dentist's office - that is, what you're thinking.

These thoughts about dental treatment can be broken down into two categories:

1) viewing the situation as one over which we have no control ("Who can control a panic attack?" "I wouldn't have the slightest idea how to begin.").

2) telling ourselves negative things about our inability to handle dental treatment in a relaxed manner.

"I'm sure he's going to hurt me."

"I shouldn't have come in here."

"He's going to think I'm stupid."

These kinds of thoughts tend to make the stress worse. So the way you interpret or think about the dental situation also contributes to stress during dental treatment.

You will notice that these two cognitive factors which help to generate and maintain the fear you feel correspond to Box 2 and Box 3 of the stress diagram presented earlier.
Stress-inoculation is a procedure in Psychology that has shown great promise in helping people to overcome a variety of fears. It is patterned after the concept of "inoculation" in medicine, the method used to protect you from a variety of diseases. In the medical concept of inoculation a weakened disease-producing agent is introduced into your body. While it is too weak to produce the disease, it does force your body to produce disease-fighting agents that can combat the real disease should you be exposed to it.

In Psychology, stress-inoculation is divided into three parts:

1) Education
2) Coping Skills Training
3) Practice

The Educational component of stress-inoculation is designed to teach you about stress and to help you understand why each of the coping skills you will learn are important.

Coping skills training is designed to provide you with methods for combatting stress. During this phase you will learn a variety of methods for effectively dealing with both your stress-producing thoughts and your body's reaction to stress.

The Practice component allows you to practice your newly learned coping skills in the presence of a very weak stress. It is enough to allow you a chance to see that your skills work for you, but not enough to overwhelm you - just as is done with medical inoculation.

Turn to the Stress Diagram on the following page.
You can see that we have made some additions to the Stress Diagram presented earlier. The first diagram was presented so you could better understand how the "Vicious Cycle of Stress" works to maintain your fear of dental treatment.

This diagram illustrates how we plan to attack that cycle during the four remaining sessions. The stress cycle can be attacked at three points - Point A, Point B, and Point C.

At Point A you will learn to combat the physical effects of stress that you currently experience when you undergo dental treatment. These are called "Physical Coping Skills". You will be taught a very effective method of progressive relaxation call the Tension-Release Method of Deep Muscle Relaxation.

At Point B we will teach you how to change the way you view you reaction to stress, how to break the stress down into parts and deal with each one individually (You've heard of "divide and conquer"?)

At Point C we will help you to identify the negative things you are telling yourself about your ability to deal with the dental situation and to replace those negative "Self-statements" or thoughts with more adaptive one that take the steam out of the stress reaction rather than helping to fire it up.

That's what you have to look forward to in the next four weeks. We hope that you will find this both an interesting and helpful experience.
The Relaxation Procedure

It is important to understand at this point that the Relaxation Response is a skill that must be learned. And it can only be learned through practice. It is not produced by simply sitting back and relaxing like you might do at home for a few minutes after dinner. The more you practice, the better you will become at producing the changes in your body that counteract the stress reaction.

The method that you are going to use to generate the Relaxation Response is called the Tension-Release (TR) method. The TR method of deep muscle relaxation involves focusing on individual muscle groups in your body. You first tense each group of muscles and then release that tension and relax them. One by one, all of the muscle groups in your body are tensed and relaxed. This exercise, combined with deep breathing, and practiced at least once daily, will enable you to call on the Relaxation Response at any time. Using this method you can, at will, create the physical changes in your body that we described earlier. Once it is learned well the Relaxation Response takes about five minutes

Practice

To practice the tension-release exercise for creating a state of deep muscle relaxation, you should find a quiet place where you will not be interrupted or disturbed by outside noises. Sit down in a comfortable chair. Loosen all tight clothing such as your tie, collar, belt, etc., and take your glasses off if you wear them. Keep both feet flat on the floor. Close your eyes and keep them closed throughout the entire exercise.

As you relax you may feel various sensations. For example, you may find that your hands or feet begin to tingle. This happens because you are opening the blood vessels in those areas of you body, thereby increasing the blood supply. You may also find that many fleeting and unrelated thoughts run through your mind. This too is natural. Just let them flow. It is not necessary to try to exclude them or to dwell on them.

A final note: don't fall asleep. The deep muscle relaxation technique is not designed to put you to sleep, but to produce changes in your body that counteract the effects of stress.
Coping With the Physical Effects of Stress

Identifying Your Own Symptoms of Stress

Most people who are afraid of dental treatment find that they experience one or more of the physical signs of stress we discussed earlier. These usually occur under two conditions:

1) anticipating dental treatment
2) actually undergoing dental treatment

The first step in coping with your body's reaction to stress is to monitor your reaction to the stressful situation, whether it be anticipating treatment or undergoing treatment. This means to tune in to your body's functioning and identify which of the physical signs of stress we discussed earlier make up your individual stress reaction. Are your muscles tight? Are your palms sweating? Is your heart racing? Which are not present? Perhaps your breathing is normal, for example.

STEP 1
IDENTIFY THE INDIVIDUAL COMPONENTS OF YOUR BODY'S REACTION TO STRESS

In the spaces below identify what you believe to be your own individual pattern of physical signs of stress. Do not limit yourself to those we have listed earlier. For example, you may get a headache or an upset stomach in addition to one or more of the other signs we've discussed.
Using Stress as a Cue

The second step in overcoming your stress reaction is to use the physical signs of stress you have identified as cues, or reminders to yourself, to begin using the coping skills you will be taught. The stress reaction you experience will begin to lose some of its power over you at this point. You will begin to use it as the signal to begin using your coping skills.

You will now learn to break the Stress Cycle by intervening at Point A. The most effective coping skill to counteract the physical signs of stress is the RELAXATION RESPONSE.

STEP II
USE THE PHYSICAL SIGNS OF STRESS AS CUES TO BEGIN COPING

The Relaxation Response

We have described the body's reaction to stress (physical signs) and the fact that you can use those signs as signals to begin coping with the stress reaction.

To counteract the stress response, the body is equipped to produce a relaxation response. Not surprisingly, the physical changes that occur in the body during relaxation are nearly opposite those that occur during stress. These include:

1. slower and deeper breathing
2. decreased heart rate
3. changes in blood flow (In this case, your hands warm up).
4. decreased muscle tension or tightness
5. decreased perspiration or sweating
6. changes in blood chemistry
7. reduced muscle tremor or shaking
Deep muscle relaxation can be used in various phases of your dental appointment. First, it can be used in anticipation of the appointment - at home before you leave for the office.

Second, it can be used in the waiting room before you are called into see the dentist. You don't need to feel embarrassed using this technique in public. The only thing another patient who is waiting would see is a calm, relaxed person (you) sitting in the waiting room with his or her eyes closed. (They'll probably be envious that you can be so relaxed. If only they knew!).

Third, you can use the technique while you're in the dental chair undergoing treatment. The only part of you that can't be relaxed at all times is your mouth, which must be open from time to time. There are times during treatment that even these muscles can be relaxed, however. As a matter of fact, the dental chair is an excellent place to relax. It supports all parts of your body and is very comfortable (you never thought of it that way, did you?).

As the dental procedure is being performed, you should scan your body continually for signs of tightness or tensesness, or any of the other signs of stress you have identified. It's easy to get tense without realizing it, so continually monitor each muscle group. At the first sign of tightness, use your new skill to relax those muscles.

**STEP III**

**USE THE RELAXATION RESPONSE TO REDUCE THE PHYSICAL SIGNS OF STRESS**
Session 3
ASSERTING YOURSELF IN THE DENTAL SITUATION

One of the principal causes of stress in the dental situation is the feeling of loss of control. You feel helpless once you sit down in the dental chair. You wonder if you have the right to ask questions or to ask the dentist to let you rest for a minute during drilling (after all, he's a busy man).

The fact of the matter is that you, as a dental patient, have a great many rights. Furthermore, exercising those rights can go a long way in giving you some control over the situation, thereby lessening the stress you experience.

Unless you believe that you have rights as a patient however, you are not likely to make use of them, or if you do, it is likely to increase your stress instead of decreasing it.

Your Rights as a Patient

As a patient there are many things you should expect from your dentist. If you don't like how you are treated, you have every right to seek treatment elsewhere. Specifically:

1. You have a right to be treated with respect and consideration. Just because you are seeking help from him, the dentist has no right to treat you in a rude or rough manner.

2. You have a right to ask questions and to have those questions answered to your satisfaction. This extends to any point in your contact with the dentist or his staff - prior to dental work, during the work itself, or after it is completed.

3. You have the right to tell the dentist when he is hurting you and to expect him to do something about it.

4. You have a right to have charges explained to you. You also have the right to ask the dentist about payment plans that may be available. (He also has the right to demand payment on completion of your appointment as long as he has indicated this in advance).

5. You have the right to ask the dentist to allow you to rest during the course of treatment (during drilling for example).
Additional Methods for Coping With Stress During Dental Treatment

While relaxation is a highly useful method for coping with the physical effects of stress, it can be made even more effective by adding strategies that have been found to be useful in helping people change their attention from the dental situation to something or somewhere else.

These strategies are very simple, but at the same time, highly effective when combined with the relaxation response. You may choose to use one or more of the following coping methods while you are actually sitting in the dental chair. After a description of each of these techniques, you should attempt to develop your own specific attention change script.

1. **Attention-diversion**: This includes focusing your attention on something other than the dental procedure that is occurring at the moment. For example, you could do mental arithmetic or attend to cues in the environment such as counting ceiling tiles, studying the features of the dentist's face, etc.

   In the spaces below list several things that exist in the dental office that you could study in detail while the dentist is working on you.

   ______________________________________
   ______________________________________
   ______________________________________
   ______________________________________
   ______________________________________
Attention-Change Strategies (continued)

2. Somatization: This involves focusing your attention on bodily processes or bodily sensations--including the dental procedure itself. For example, you could focus all of your attention on the vibrations or sound of the drill. If you do this successfully, the entire process will begin to take on a very unreal tone--and you will effectively remove yourself (in mind, not in body) from the situation.

In this category we could also include focusing on your different muscle groups so that they remain relaxed. You could also focus on your breathing - giving it your full attention. Slow your breathing down; make yourself breathe slowly and evenly. How does your diaphragm feel as it goes up and down?

3. Imagery Manipulations: This involves changing or transforming the experience of the dental procedure by means of fantasy. The more elaborate, detailed, and involved the fantasy, the greater the amount of stress or pain tolerance. There are several different uses of imagery possible.

a) imaginative inattention: In this case you ignore the dental situation by engaging in "goal directed fantasy" which, if real, would be incompatible with the experience of stress or pain. We will call this your "Calm Scene". You will develop it in detail below.

b) imaginative transformation of stress or pain: Here, you include the experience of pain in the fantasy but you transform or interpret these sensations as something other than pain or minimize the sensation as unreal or trivial. During an injection for example, you could focus your attention on comparing the sensation of the injection with what you would feel if you were pinched or if you banged your arm on the table.

c) imaginative transformation of context: In this case, you also include your stress or pain in the fantasy, but you transform the context or setting in which they occur. For example, you could imagine that you are an astronaut, seated in a command module. The sensation of the drill could be transformed into the incredible roar and physical stress that accompanies taking off. The vibration could be the vibration of the entire ship as the engines ignite.

We will now discuss how to develop an effective "Calm Scene" for use during deep muscle relaxation.
THE CALM SCENE

One method for increasing the usefulness of the deep muscle relaxation procedure as a method for reducing stress is to combine it with active fantasy. The best way to do this is to develop the fantasy in advance and to practice using it before you are called upon to use it "for real". We have called this fantasy a Calm Scene. Pairing it with a state of deep relaxation during practice will allow you to call upon this fantasy as an aid to relaxation in a stress-producing situation.

Figure 5-1. Two dental patient situations: (A) Situation 1, an apprehensive patient, anticipating the worst. (B) Meditating patient, taking a pleasant mental trip. Situation 2.

The most important thing in choosing a calm scene is to select one that already has relaxing properties, perhaps a scene from a vacation you've taken that was particularly pleasant. An example of a calm scene is presented on the following page.
On A Tropical Island

Imagine yourself basking in the sun on a beautiful tropical island. You can feel the heat of the sun on every inch of your body. There is a slight breeze rustling the palm trees. In the distance you hear the dim sound of an airplane. Above you the sky is a deep blue and far above the island several white birds contrast against the sky. You can hear the waves breaking on the beach in a gentle rhythm; they almost lull you to sleep. Beneath you the sand is warm. You feel calm, happy, and very relaxed. You don't have a care in the world.

Guidelines for Selecting A Calm Scene (Cheek, 1974)

Now try to imagine in your mind a calm scene in as much detail as the one described above. When you have your calm scene clearly in mind, we will go around the room and ask each of you to describe your scene in detail to the others. Then, if you have any problems visualizing a calm scene, we will discuss it with you and try to help you imagine a scene which will be useful to you in the relaxation exercise.

In selecting a calm scene to use in the relaxation exercise, try to select one that meets the following guidelines. If a scene you like meets most but not all of the guidelines it may still be a good one.

1. **Specific scene.** The scene should be a specific place—not just something vague like "in the woods" or "fishing". Think of each scene as a "snap-shot":

2. **All senses.** To make your imagined scene clearer, try to use all of your senses. While you imagine your calm scene, what do you see, what do you hear, what do you smell, what do you feel? Notice how the example given above brings in all the senses.

3. **No other persons.** The scene should not include any people you know—family members, friends, or co-workers. The reason for this is that there may be times when imagining these people will produce tensions or other thoughts that disrupt the calm scene. (It is allowable, however, to have groups of people you don't know in your calm scene. For example, it would be all right to imagine yourself on a boardwalk with groups of people in the distance).

4. **No active movement or excitement.** It is all right to imagine yourself slowly walking along, but avoid active movement or excitement.

5. **Something you can experience yourself.** The calm scene should be something you have actually experienced, and preferably can occasionally be re-experienced to refresh the scene in your mind.

6. **Keep the same scene.** After you settle on a particular calm scene, stay with it. It is important to have one scene that you keep using so that scene can become a trigger to produce in you a completely relaxed state. If you can't decide immediately, try one scene, such as being at the beach, then change later if you still wish to do so.
Session 4
COGNITIVE FACTORS IN STRESS

One goal of our program is for each of you to become aware of the factors which are maintaining your anxiety in the dental situation. Once we can determine what these factors are, then we can change or combat them. One of the surprising things is that the factors contributing to anxiety are not something secretive, but seem to be the thinking processes you go through in the dental situation. Simply, there seems to be a correlation between how anxious and tense people feel and the kinds of thoughts they are experiencing. For example, the anxiety you experience in the dental situation may be tied to the kinds of thoughts you had, what you chose to think about, or how you chose to focus your attention.

To control our thinking, we must first become aware of when we are producing negative self-statements or catastrophizing. ("What if the needle breaks off in my mouth"). The recognition that we are, in fact, doing this will be a step forward in changing.

First, however, it is important that you understand how our thoughts about a situation can generate what we have been calling a stress reaction. This is not a new idea. Two thousand years ago Epictetus summed up the idea when he said "Man is not disturbed by things, but the views he takes of them".

Consider the following scene. Two individuals, both of whom possess essentially the same speaking skills, are asked on separate occasions to present a public speech. The two individuals differ in their level of speech anxiety: One has high speech-anxiety, the other, low speech-anxiety. During each speaker's presentation, some members of the audience walk out of the room. This exodus elicits quite different self-statements or appraisals from the high versus the low speech-anxiety individuals. The high speech-anxiety individual is likely to say to himself: "I must be boring. How much longer do I have to speak? I knew I never could give a speech," and so forth. These self-statements both reflect and engender anxiety and in turn become self-fulfilling prophecies. On the other hand, the low speech-anxiety individual is more likely to view the audience's departure as a sign of rudeness or to attribute their leaving to external circumstances. In his internal dialogue he is likely to say something like: "They must have a class to catch. Too bad they have to leave; they will likely miss a good talk".

This example suggests that how you respond to stress in large part is influenced by how you appraise the stressor, to what you attribute the arousal you feel, and how you assess your ability to cope. After all, if it were the speech itself that caused high anxiety for the speaker, both of the individuals in the above example would have felt anxious. Since only one experienced anxiety it could not have been the speech that caused it. It must have been something else. We are suggesting that that something else is the manner in which the events that occurred during the speech were viewed by the high speech-anxiety individual.
Identifying Negative Self-Statements

In identifying negative self-statements it is important to look at what you are saying to yourself during each aspect of the dental situation—before, during, and after. Each time frame has its own impact on maintaining or making worse your stress reaction.

There are certain cues that may help you identify the negative thoughts that cause stress. (Meichenbaum, 1974)

1) A negative thought may have a "worry quality" such as "I'm afraid...," or a "self-oriented quality" such as "I won't do well".

2) Negative thoughts also may include elements of catastrophizing, ("If I fail, it will be terrible") or exaggerating (I never do well" or I always blow it").

In general, negative thoughts can be identified by asking the following three questions: (Goldfried, 1976).

1. Do I make unreasonable demands of myself?
2. Do I feel that others are approving or disapproving of my actions?
3. Do I often forget that this situation is only one part of my life?

Look at the following examples:

<table>
<thead>
<tr>
<th>Negative Self-Statement</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I'll never be able to calm down.&quot;</td>
<td>Never means you have no chance at all.</td>
</tr>
<tr>
<td>&quot;How can I ever relax when I know this is ... You are doubting your ability and going to hurt.&quot;</td>
<td>Catastrophizing.</td>
</tr>
<tr>
<td>&quot;He's going to think I'm stupid!&quot;</td>
<td>You are anticipating a negative reaction with no evidence.</td>
</tr>
<tr>
<td>&quot;What if he makes a mistake.&quot;</td>
<td>Catastrophizing.</td>
</tr>
<tr>
<td>&quot;I should never have come in here.&quot;</td>
<td>Expecting the worse. Viewing the situation from a negative perspective.</td>
</tr>
</tbody>
</table>

Assignment

GENERATE THE NEGATIVE SELF-STATEMENTS THAT YOU USE TO MAINTAIN AND MAKE WORSE YOUR STRESS AND ANXIETY RELATED TO THE DENTAL SITUATION. ANALYZE BEFORE, DURING, AND AFTER A DENTAL VISIT.
Cognitive Factors Related to Stress in the Dental Office

While it is certainly true that you are exposed to various stressors in the dental office, it is true that it is not necessary to react to those stressors with a full blown stress reaction. Up to this point you may have been of the opinion that such a reaction must occur as a result of exposure to a stressor. This is obviously not the case, given what we have presented so far. Just as it was not the speech itself that caused the anxiety in the high speech anxious individual discussed earlier (although if you asked him why he was anxious he would say it was because he had to give a speech), it is not the dental situation itself that makes you anxious (although you have always thought it was). If it were the dental situation that was making you anxious, or that contained characteristics that must cause anxiety, it could elicit anxiety in everybody. And we know that not everybody is made greatly anxious by the dental situation. The only conclusion we can draw is that the cause of the anxiety is something other than the dental situation.

We are again suggesting that that something else is the the manner in which the events or potential events are viewed by the person who experiences panic in the dental chair.

These thoughts, or negative self-statements, are very powerful in their ability to maintain the Cycle of Stress we discussed earlier. These thoughts can be broken down into two categories which were introduced to you as Box 2 and Box 3 of the stress diagram presented earlier. They are:

1) viewing the situation as one over which we have no control ("Who can control a panic attack?" "I wouldn't have the slightest idea how to begin.")

2) telling ourselves negative things about our inability to handle dental treatment in a relaxed manner.

"I'm sure he's going to hurt me."

"I shouldn't have come in here."

"He's going to think I'm stupid."

The next step is to identify the specific negative self-statements you are using to keep yourself anxious. Examples of negative, self-defeating beliefs are on the next page along with positive statements that might be used to replace them.
Replacing Negative Thoughts With Positive Thoughts

NEGATIVE

Before Appointment

"I really don't want to do this".
"What if I'm still anxious, he'll think I'm stupid".
"What excuse can I make up to get out of this"?
"I hate going to the dentist".

In the Waiting Room

"I hate this place".
"The smell in here is terrible".
"The sound of that drill drives me crazy".
"I would rather be any place but here".

In the Dental Chair

"I know this is going to hurt".
"Those instruments look mean—if one slipped it would do a lot of damage.
"I'm sure he's going to see me shaking—why can't I be calm"?
"Oh no, here comes the needle. Please, please don't hurt me".
"He's never going to finish the drilling".

When Treatment is Finished

"I must have looked stupid being so upset".
"I'm never coming in again".
"What a horrible experience".
"All dentists are SOBs".

POSITIVE

Before Appointment

"This will be a good chance to try my coping skills".
"I know I'm still going to feel somewhat anxious, but I understand that
feeling better now".
"I'm glad I got an appointment first thing in the morning. It pays
to be assertive".
"I'm sure glad that I've finally gotten up the courage to get this
dental work done".

In the Waiting Room

"Here I am. So far so good. I can start to relax".
"I never noticed those pictures".
"So I'm anxious. I'm always going to be a little that way. I'm
glad I've been practicing my relaxation".
"There are a lot of places worse than this. If being here is the
biggest problem I have, I'm in pretty good shape".
In the Dental Chair

"I wonder how close I can come to transporting myself into my calm scene".
"These new chairs are neat. I wonder if the astronauts couches feel like this"?
I'm doing pretty good, I can handle this.
"This drilling is lasting pretty long. I'm going to ask him if we can take a break for a minute or so".
"If this hurts more than being a little uncomfortable, I'm going to find a different dentist. I know that there is no reason to endure any great amount of pain. Not all dentists are alike, afterall".

When Treatment is Finished

"That was the best I've ever done".
"Everytime I come back I'm going to be a little better at it".
"Wait until ______ hears about how I've improved".
Session 5  
Putting It All Together

Earlier we discussed how your body's reaction to the stress of a dental visit was not one overwhelming panic attack, but was actually made up of several smaller physical reactions. You learned that by using deep muscle relaxation you could control those feelings.

In addition to the physical reaction you experience when you are stressed, you experience a cognitive reaction as well. This cognitive reaction is composed of what seems like many thoughts racing through your head over which, it would appear, you have little control. These lead to feelings of helplessness and loss of control. If you are to break the circle of stress, you must also learn to control your thought processes.

Now you will learn a method of cognitive control that will help you to plan a strategy for dealing with thoughts that only make stress worse. Rather than allowing your fear-producing thoughts to whirl around in your head non-stop, it is important that you assert control over your thinking. This is made easier by breaking down your thought processes into four points. These are four times that are important in your learning to use coping thoughts, and we'll work on each of these four phases:

1. First, is how you interpret the situation initially, and how you think about responding or preparing to respond.

2. Second is actually dealing with the situation.

3. Third is coping with anything that happens during the dental procedure that is particularly upsetting.

4. And fourth, you will learn to encourage yourself for dealing with the situation in a more successful manner.
PREPARING FOR A STRESSOR

1. What is it you have to do?
2. You can develop a plan to deal with it.
3. Just think about what you can do about it. That's better than getting anxious.
4. No negative self-statements; just think rationally.
5. Don't worry; worry won't help anything.
6. Rather than looking upon this as anxiety, look upon it as eagerness to confront the situation.

CONFRONTING AND HANDLING A STRESSOR

1. Just "psych" yourself up - you can meet this challenge.
2. One step at a time; you can handle the situation.
3. Don't think about fear; just think about what you have to do. Stay relevant.
4. You were told you would feel this anxiety. It's just a reminder to use your coping exercises.
5. This tenseness can be an ally, a cue to cope.
6. Relax; you're in control. Take a slow deep breath. Ah, good.
COPING WITH THE FEELING OF BEING OVERWHELMED

1. When fear comes, just pause.
2. Keep the focus on the present; what is it you have to do?
3. Label your fear from 0 to 10 and watch it change.
4. You should expect your fear to rise.
5. Don't try to eliminate fear totally; just keep it manageable.
6. You can convince yourself to do it. You can reason away your fear.
7. It will be over shortly.
8. It's not the worse thing that can happen.
10. Do something that will prevent you from thinking about fear.
11. Describe what is around you. That way you won't think about worrying.

REINFORCING SELF-STATEMENTS

1. It worked; you did it! Wait until you tell _______ about this.
2. It wasn't as bad as you expected.
3. You made more out of the fear than it was worth.
4. Your damn ideas— that's the problem. When you control them, you control your fear.
5. It's getting better each time you use the procedures.
6. You can be pleased with the progress you're making.
7. You did it!
INTRODUCTION

Those of us associated with the Dental Fear Project would like to welcome you. Each of you have become involved in this Project because you have one thing in common - a fear of dental treatment. Some of you have totally avoided any contact with the dentist for quite some time. Others have been able to have some dental work performed, but have found it to be a highly unpleasant experience. The fact that you are now involved with others who share this fear is a first step in overcoming it. Up to this point you may have felt that you were almost alone in fearing dental treatment. The fact is that more than 10 million people in this country avoid dental work because of fear. You have lots of company.

The purpose of this manual is to provide you with a summary of what will be presented during each treatment session. This will free you from taking notes and allow you to fully concentrate on the material being presented. You are encouraged to review the information that is presented here between sessions. This information can guide you in developing skills to cope with the stress associated with dental treatment. But changes in the way you cope with this stress will depend on your willingness to practice the behaviors that you will be introduced to. Your attendance at each session is necessary if you are to fully benefit from the Program.
Fear of Dental Treatment

Why are so many people afraid of modern dentistry, which in most cases, is relatively painless? There is no clear-cut answer to this question. Many people have had one or more negative experiences with dental treatment in the past. Often this may have involved experiencing extreme pain during a dental procedure. Others have had to deal with dentists who were rough or treated them in a callous or rude manner. Still other fearful individuals have learned to fear dental treatment because of "horror stories" they've heard from others, perhaps parents, family members, or friends. What is clear about dental fear, however, is that in each case, it has been learned.

Why Can't I Seem to Get Over It?

Just as each of you has somehow learned to fear dental treatment, the ability to overcome this fear will depend upon your ability to learn skills to cope with it. Unfortunately, to this point, you've never had the chance. Typically, the fearful individual never has the opportunity to learn that dental treatment need not be a negative, scary, or painful experience.

Suppose you have been avoiding dental treatment for a long time, for example. You develop a tooth ache or gum disease because of failure to have needed dental work performed. Eventually, a trip to the dentist becomes necessary. You arrive for your appointment and the following things happen:

1. The dentist scolds you for allowing your mouth to get into such awful shape. What's worse, you know he's right.

2. The procedure, because of its nature as a dental emergency, coupled with a lack of past care, is lengthy and painful.

3. The high level of anxiety that you feel makes the pain even worse (anxiety almost always increases the experience of pain).

4. You've been humiliated and hurt. The overall experience is so negative that you swear you'll never go to the dentist again— and you don't— until the next time an emergency arises, and ...

5. the entire procedure repeats itself.

Under these circumstances, it is not surprising that you tend to avoid the dentist.
A Second Example

Let's take a less extreme example. You can go to the dentist to have needed work done, but it's a very, very uncomfortable experience. You begin dreading your upcoming appointment. By the time you are sitting in the dental chair (assuming you haven't cancelled your appointment), your muscles are very tight. Your heart is racing. The smell of the office is unpleasant and reminds you of how bad it was last time. The instruments look very threatening. You find that your hands are wet and cold and your breathing is shallow. The dentist begins picking at your teeth with one of his instruments. By this time even the slightest pressure or pain is enough to send you through the roof. Your anxiety makes what little discomfort there is turn into excruciating pain. You feel completely out of control and helpless. You may be afraid that the dentist will notice how scared and tense you are (he will), and that he'll think you're crazy (he won't, but you do). You're afraid you'll embarrass yourself.

What has just been described is a stress reaction.
It should be clear by now why it is so difficult to overcome your fear of dental treatment. We have diagramed the stress cycle below.

First, look at Box 1, "Physiological Arousal". Here, your past associations cause your heart to beat faster and your hands to get cold. Your body starts to produce adrenaline.

Next, at Point 2, "Automatic Appraisal of Situation as Anxiety", you interpret this feeling in your body as one giant panic reaction. You feel completely out of control.

At Point 3 you become angry and annoyed at yourself for handling the situation so poorly. You figure there must be something wrong with you and you know that the next visit to the dentist will also be a terrible experience.

Point 2 and Point 3 combine to cause even greater physiological arousal (Box 1) and the whole cycle starts over, only this time it's a little worse. A few times around this circle and you've really got yourself worked up!
Session 3

Understanding Stress

Stress is a reaction to either a physical or psychological threat. In either case, it is the same reaction. That is, the stress reaction that is generated by your body to help you deal effectively (cope) with real physical danger (for example, being robbed at gun-point) is the same reaction that occurs when you are confronted with a psychological threat. When a physical threat is involved, your body's reaction makes sense. By increasing the level of adrenaline in your blood and causing your heart to race faster, you are being prepared to either fight the threat, or run away from it.

Psychological stress on the other hand requires no such arousal. As a matter of fact, such arousal can interfere with your ability to cope (Have you ever forgotten what you wanted to say because you were nervous?). Most psychological stress is highly personalized. That is, what may seem like a threat to some people may not to others. For example, not every one is stressed by speaking in public (or going to the dentist), while others simply cannot do it at all.

Identifying Stress

Before you can learn to manage stress, you must first learn to identify it. The stress reaction is not one, overwhelming, panic attack, although it may seem that way while you are sitting in the dentist's office. Stress can be divided into two components:

1. physical signs of stress (your body's reactions)
2. cognitive signs of stress (your thought processes)

We will now begin to break the stress reaction down into its several parts. You will see that your reaction to the dentist's office is not as all-powerful as it might seem at first. It is really made up of many small reactions, each of which can be controlled. We will now take a closer look at the physical and cognitive signs of stress.
Physical Signs of Stress

People who are highly anxious during dental treatment are often scared by the reactions of their own bodies while dental procedures are being performed. They may think that the feelings they are experiencing (ra·ing heart, etc.) mean that there is something seriously wrong with them. They may believe they are having a heart attack or a nervous breakdown. They may believe they are going "crazy" for having such a strong response to a procedure they know is not only harmless, but necessary for the maintenance of good overall health. None of this is true. While it may be an unpleasant feeling, it is not dangerous. It does not mean that there is something wrong with you, either physically or mentally.

The body tends to respond to stress in an automatic way, although not everyone reacts in exactly the same manner. The following are some of the more frequent physical signs of stress:

1. faster and more shallow breathing
2. increased heart rate
3. changes in blood flow - constriction of vessels in the hands and feet. (This is why your hands get cold).
4. increased muscle tension or tightness
5. increased perspiration or sweating
6. changes in blood chemistry (for example, more adrenaline).
7. muscle tremor or shaking or tremor

Viewed this way, the anxiety you feel while you anticipate or actually undergo dental treatment, what we have called the stress reaction, need not be overwhelming. It is made up of many small parts, each of which can be overcome. It is important that you understand this, because the way you interpret, or view, the stress reaction that you feel while sitting in the dentist's chair will, to a large extent, determine how severe it will be.

This brings us to the role of cognitive factors in the stress reaction.
Session 4
Cognitive Factors in Stress

One goal of our program is for each of you to become aware of the factors which are maintaining your anxiety in the dental situation. Once we can determine what these factors are, then we can change or combat them. One of the surprising things is that the factors contributing to anxiety are not something secretive, but seem to be the thinking processes you go through in the dental situation. Simply, there seems to be a correlation between how anxious and tense people feel and the kinds of thoughts they are experiencing. For example, the anxiety you experience in the dental situation may be tied to the kinds of thoughts you had, what you chose to think about, or how you chose to focus your attention.

To control our thinking, we must first become aware of when we are producing negative self-statements or catastrophizing. ("What if the needle breaks off in my mouth"). The recognition that we are, in fact, doing this will be a step forward in changing.

First, however, it is important that you understand how our thoughts about a situation can generate what we have been calling a stress reaction. This is not a new idea. Two thousand years ago Epictetus summed up the idea when he said "Man is not disturbed by things, but the views he takes of them".

Consider the following scene. Two individuals, both of whom possess essentially the same speaking skills, are asked on separate occasions to present a public speech. The two individuals differ in their level of speech anxiety: One has high speech-anxiety, the other, low speech-anxiety. During each speaker's presentation, some members of the audience walk out of the room. This exodus elicits quite different self-statements or appraisals from the high versus the low speech-anxiety individuals. The high speech-anxiety individual is likely to say to himself: "I must be boring. How much longer do I have to speak? I knew I never could give a speech," and so forth. These self-statements both reflect and engender anxiety and in turn become self-fulfilling prophecies. On the other hand, the low speech-anxiety individual is more likely to view the audience's departure as a sign of rudeness or to attribute their leaving to external circumstances. In his internal dialogue he is likely to say something like: "They must have a class to catch. Too bad they have to leave; they will likely miss a good talk".

This example suggests that how you respond to stress in large part is influenced by how you appraise the stressor, to what you attribute the arousal you feel, and how you assess your ability to cope. After all, if it were the speech itself that caused high anxiety for the speaker, both of the individuals in the above example would have felt anxious. Since only one experienced anxiety it could not have been the speech that caused it. It must have been something else. We are suggesting that that something else is the manner in which the events that occurred during the speech were viewed by the high speech-anxiety individual.
Cognitive Factors Related to Stress in the Dental Office

While it is certainly true that you are exposed to various stressors in the dental office, it is true that it is not necessary to react to those stressors with a full blown stress reaction. Up to this point you may have been of the opinion that such a reaction must occur as a result of exposure to a stressor. This is obviously not the case, given what we have presented so far. Just as it was not the speech itself that caused the anxiety in the high speech anxious individual discussed earlier (although if you asked him why he was anxious he would say it was because he had to give a speech), it is not the dental situation itself that makes you anxious (although you have always thought it was). If it were the dental situation that was making you anxious, or that contained characteristics that must cause anxiety, it could elicit anxiety in everybody. And we know that not everybody is made greatly anxious by the dental situation. The only conclusion we can draw is that the cause of the anxiety is something other than the dental situation.

We are again suggesting that that something else is the the manner in which the events or potential events are viewed by the person who experiences panic in the dental chair.

These thoughts, or negative self-statements, are very powerful in their ability to maintain the Cycle of Stress we discussed earlier. These thoughts can be broken down into two categories which were introduced to you as Box 2 and Box 3 of the stress diagram presented earlier. They are:

1) viewing the situation as one over which we have no control
   ("Who can control a panic attack?" "I wouldn't have the slightest idea how to begin.")

2) telling ourselves negative things about our inability to handle dental treatment in a relaxed manner.
   "I'm sure he's going to hurt me."
   "I shouldn't have come in here."
   "He's going to think I'm stupid."

The next step is to identify the specific negative self-statements you are using to keep yourself anxious.
Identifying Negative Self-Statements

In identifying negative self-statements it is important to look at what you are saying to yourself during each aspect of the dental situation—before, during, and after. Each time frame has its own impact on maintaining or making worse your stress reaction.

There are certain cues that may help you identify the negative thoughts that cause stress. (Meichenbaum, 1974)

1) A negative thought may have a "worry quality" such as "I'm afraid...," or a "self-oriented quality" such as "I won't do well".

2) Negative thoughts also may include elements of catastrophizing, ("If I fail, it will be terrible") or exaggerating (I never do well" or I always blow it").

In general, negative thoughts can be identified by asking the following three questions: (Goldfried, 1976).

1. Do I make unreasonable demands of myself?
2. Do I feel that others are approving or disapproving of my actions?
3. Do I often forget that this situation is only one part of my life?

Look at the following examples:

<table>
<thead>
<tr>
<th>Negative Self-Statement</th>
<th>Feedback</th>
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<tbody>
<tr>
<td>&quot;I'll never be able to calm down.&quot; ........ Never means you have no chance at all.</td>
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<tr>
<td>&quot;How can I ever relax when I know this is ... You are doubting your ability and going to hurt.&quot; catastrophe.</td>
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<tr>
<td>&quot;He's going to think I'm stupid!&quot; ........... You are anticipating a negative reaction with no evidence.</td>
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<tr>
<td>&quot;What if he makes a mistake.&quot; ............. Catastrophizing.</td>
<td></td>
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<tr>
<td>&quot;I should never have come in here.&quot; ...... Expecting the worse. Viewing the situation from a negative perspective.</td>
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Assignment

GENERATE THE NEGATIVE SELF-STATEMENTS THAT YOU USE TO MAINTAIN AND MAKE WORSE YOUR STRESS AND ANXIETY RELATED TO THE DENTAL SITUATION. ANALYZE BEFORE, DURING, AND AFTER A DENTAL VISIT.
Session 5

One method that helps to overcome fear of any object or situation is to gain as much information about it as you can. Up to now, chances are that you have never had any contact with a dentist other than when you sought him out for treatment. Because of the anxiety associated with the treatment situation, this is not the best time to increase your fund of information about dentistry and dentists. Anxiety can make it most difficult to absorb and integrate information. In addition, during office hours dentists rarely have the time to chat about issues you may be curious about, but that have little or no relevance to your need for treatment. Many dentists, and other professionals for that matter, find it difficult to drop the professional shield they use in dealing with patients.

If you could talk to a dentist in an informal atmosphere, away from the anxiety associated with the dental office, what would you ask him? What kinds of information would you find useful? What questions would help to satisfy your curiosity about what appears to most of us as a pretty mysterious set of procedures?

Tonight you will have the opportunity to meet with a dentist away from the dental office. You should take advantage of this opportunity to satisfy your curiosity about even the smallest detail of his work, training, feelings, and any other area that will help you better understand not only dental procedures, but the dentist as a person.

Take time now to discuss how you would like to spend this time and what questions you would like to ask. Perhaps you'd like to get something off your chest.

Examples of things you might be interested in are:

1) What makes modern dentistry any better than it used to be?

2) How much pain should there be in dental work?
   a. during the injection
   b. during drilling

3) What training do you get in school regarding dealing with the fearful patient?

4) What do you think about when you are working with someone who is obviously fearful?

5) What are all the tools for? Do they ever slip?
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A COMPARISON OF STRESS INOCULATION TRAINING AND
STRESS EDUCATION IN THE TREATMENT OF STRESS
ASSOCIATED WITH DENTAL PROCEDURES

by
Charles Perry Bosmajian, Jr.

(ABSTRACT)

Stress inoculation training has been suggested as a viable approach to the treatment of such stress-related behaviors as self-reported distress, physiological arousal, and behavioral avoidance. Previous research has concluded that training in coping skills constitutes the "active ingredient" of the treatment package, while education about the nature and effects of stress is not sufficient to produce behavior change. The data-base supporting these conclusions however, is composed primarily of experimental results with analogue or non clinical populations. The present study was designed to compare the relative effectiveness of stress inoculation training and stress education in reducing stress related behaviors in a population confronting a personally relevant stressor.

The study utilized a four group repeated measures design which included two treatment groups composed of subjects who were fearful of dental procedures (stress inoculation and stress education) and two control groups. The high fear no treatment control group was also composed of subjects who were fearful of dental procedures but were unable to participate in treatment because of scheduling difficulties. The low fear validation control subjects were included in order to validate the dependent measures utilized in the study with
respect to their ability to discriminate high fear from low fear individuals. Subjects were 13 adult males and 19 adult females. All high fear subjects were either self-referred, referred by their personal dentists, or identified as fearful of dental procedures by their responses to the Dental Anxiety Scale, using a score of one standard deviation above the mean as the criterion for inclusion. Low fear subjects all scored at least one standard deviation below the mean of the same scale.

Analysis of covariance, using pre treatment scores as the co-variate, indicated that stress inoculation subjects differed from high fear controls at post treatment on the variables of trait anxiety, overall rating of fear of dentistry, number of negative self-statements, the anticipation factor of the Dental Fear Survey, and the behavioral avoidance test. Stress education subjects did not differ from high fear controls on any measure at post treatment. Analysis of covariance also indicated however, that there were no significant differences between stress inoculation training and stress education at post-treatment. Because of the regression model's poor fit in the analysis of covariance for the plasma cortisol values (R-square=.12), a repeated measures analysis of variance was utilized for that variable. Results indicated that both stress inoculation and stress education subjects showed significant reductions in plasma cortisol values from pre treatment to post treatment assessment. A small and statistically insignificant reduction was observed for high fear no treatment control subjects. A 10-month follow-up revealed that 100 percent of both the stress inoculation and stress education subjects had seen a dentist
whereas only 60 percent of the high fear control subjects had made and kept a dental appointment.

Results are discussed in terms of the relative efficacy of the two treatment procedures for use with fearful dental patients and findings are related to predictions generated by Bandura's theory of self-efficacy.