THE EFFECTS OF AUDIOANALGESIA ON PAIN, STATE ANXIETY AND PERIPHERAL TEMPERATURE OF ADULT BURN PATIENTS DURING POST-ACUTE REHABILITATIVE EXERCISE

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We hereby recommend that the thesis prepared under our supervision by Donna J. Nothdurft entitled The Effects of Audioanalgesia on Pain, State Anxiety and Peripheral Temperature of Adult Burn Patients During Post-Acute Rehabilitative Exercise

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CHAPTER I

INTRODUCTION

Pain is virtually a universal experience of mankind. Nevertheless, it is uncommonly difficult to define. An elusive phenomenon, pain is generally described as having two dimensions: sensory and emotional. In its simplest definition the sensory phenomenon is evoked by stimuli which injure or threaten to injure tissue (Ignelzi & Atkinson, 1980). The emotional dimension is associated with cognitively mediated variables such as anxiety and fear (Grzesiak, 1975).

Like pain, anxiety is a complex phenomenon. With differing emphasis, several personality theorists tend to agree that anxiety is learned in infancy, is experientially unpleasant, and is associated with perceived threat. Spielberger (1966) differentiated between two types of anxiety: state anxiety (A-state) which is a transitory emotional state that fluctuates over time and varies in intensity, and trait anxiety (A-trait) which is a predispositional tendency to perceive an event as threatening.

There is often difficulty in distinguishing between anxiety and pain because of the fact that these terms refer to constructs. It is thought, however, that anxiety can be part of or can amplify the pain experience or that pain can cause anxiety (Schacham & Daut, 1981). The relationship between pain and anxiety and the possible associated physiological responses are of particular concern to the field of health care. A study by Kenner and Achterberg (1983) indicated that measurements that showed usefulness and can be considered as future dependent variables in pain studies include subjective pain, state anxiety questions and peripheral body temperature.

The need for improved methods of pain control mandates continued research on pain and its possible modulation by chemical, surgical, physiological or psychological procedures. In the past two decades, a new method to suppress pain was introduced into medicine and dentistry. This technique was officially recognized as audioanalgesia, which literally means the suppression of pain by sound, i.e., white noise and/or stereophonic music being presented to the patient via earphones (Marone, 1968).

The use of music as an intervention for pain during therapeutic exercise is unknown. Exercise, a major component of rehabilitation after severe burn injury is a necessary and frequently a painful experience. In the post-acute phase of burn rehabilitation, therapeutic exercise programs are comprised of stretching of the newly healed tissues as scarring and tightness of the skin and skin grafts pose major threats to the patient's movement and function. Therapists often find patients resistive to their exercise programs due to sensitive skin and low tolerance for pain. Techniques diminishing levels of perceived pain during post-acute exercise sessions would be invaluable to both patient and therapist.

Statement of the Problem

The problem or question addressed in this study was: Does audioanalgesia alter the level of pain, level of state anxiety, and peripheral body temperature during post-acute rehabilitative exercise with adult subjects with burns?

Statement of Purpose

The primary purpose relevant to the investigation was to examine the perceived level of pain of adult subjects with burns, before and during therapeutic exercise sessions, with and without audioanalgesia, using and A-State Anxiety Inventory, Visual Analog Pain Scale and recordings of peripheral body temperature as measures.

Research Questions

The following list includes those research questions relevant to this investigative study. All questions were addressed for both the individual adult subject with burns and the total group of subjects with burns.

1. Is there a difference in pain levels reported by adult subjects with burns during post-acute exercise with and without audioanalgesia over time?

2. Is there a difference in state anxiety levels reported by adult subjects with burns during post-acute exercise with and without audioanalgesia over time?

3. Is there a difference in peripheral body temperature of adult subjects with burns during post-acute exercise with and without audioanalgesia over time?

4. Is there a relationship between pain level and state anxiety level reported by adult subjects with burns during post-acute exercise with audioanalgesia?

5. Is there a relationship between pain level and state anxiety level reported by adult subjects with burns during post-acute exercise without audioanalgesia?

6. Is there a relationship between pain level and peripheral body temperature of adult subjects with burns during post-acute exercise with audioanalgesia?

7. Is there a relationship between pain level and peripheral body temperature of adult subjects with burns during post-acute exercise without audioanalgesia?

8. Is there a relationship between state anxiety level and peripheral body temperature of adult subjects with burns during post-acute exercise with audioanalgesia?

9. Is there a relationship between state anxiety level and peripheral body temperature of adult subjects with burns during post-acute exercise without audioanalgesia?

Definition of Terms

The following definitions were applied to terms used in this study:

Audioanalgesia. The suppression of pain by sound; selected stereophonic music presented to the subject via earphones.

Exercise Program. The prescribed upper extremity therapeutic exercise program comprised of stretching of newly healed burns and scar tissue in an effort to maintain skin pliability and full joint range of motion.

Pain. The patient's subjective report of his or her perceived pain level as indicated on the Visual Analog Pain Scale before and during exercise.

Perception. To become aware of in one's mind; an awareness of pain in the subject's mind.

Peripheral Body Temperature. A patient's body temperature as measured in degrees Fahrenheit using the Autogen 1000b Feedback Thermometer with the thermal probe placement on the interior arch of the right foot.

Post-Acute. The stage of recovery after burn injury when major tissue healing has occurred and functional restoration is the emphasis of rehabilitation. Generally the out-patient stage of rehabilitation.

State-Anxiety. The transitory emotional state or condition of the human organism that varies in intensity and fluctuates over time. The patient's subjective report of his level of anxiety on the A-State Anxiety Inventory. (Spielberger, 1966)

Suppression. A lessening in the awareness of the perceived pain level using audioanalgesia.

Treatment Session. A 20 minute time period in which the therapist and patient engage in the prescribed therapeutic exercise program.

Assumptions

The assumptions having relevance to this study included:

1. Pain is an individual physiologic phenomenon which can be affected by appropriate procedures.

2. All patients experience pain during post-acute rehabilitative exercise.

3. Pain relief is desirable.

4. Pain perception differs according to time of day, therefore consistency of treatment time is desirable.

5. Patients did not take any medications which would influence the perceived pain as reported by the patient.

6. Patients received explanations as to the need for and importance of exercise during post-acute burn rehabilitation.

7. Patients responded truthfully to requested information.

8. Patients had no unusual problems with healing as it relates to burn injury such as infection, excessive skin breakdown or the like.

9. Patients desired to engage in prescribed exercise programs in order to gain optimum functional ability.

10. Patients carried out home exercise programs and activity in addition to the exercise during formal therapy in the out-patient clinic.

11. Withholding or introducing treatment (audioanalgesia) during the initial session, alternating thereafter, did not affect the results of the study.

12. The type of musical tape selected made no difference in influencing the perceived pain.

Limitations

Limitations of this study included:

1. Pain and state anxiety levels reported by the patient were subjective.
2. Patients served as their own controls.
3. A convenient sample used in this quasi-experimental study.
4. Size of the sample was small.
5. Lack of control over a patient's previous pain experience particularly during the acute phase of burn rehabilitation.
6. Lack of control over the psychological make-up of the patient before and after burn injury.
7. Day by day fluctuations of the patient's responses.
8. The effects of exercise over time or accommodation to exercise.
9. Reliability of the measuring instruments.
10. Therapist interaction/rapport with the patient.
11. Possible presence of the Hawthorne Effect.

Significance of the Study

Therapists are often confronted with manipulative and resistive patients who are in the post-acute stages of burn rehabilitation. A patient's resistance towards exercise is often due to the fear and apprehension of pain generally associated with the stretching of the newly healing tissues. The therapist's concern should be directed towards planning and implementing therapeutic interventions.

Methods of suppressing or lessening perceived pain may alleviate major problems in rehabilitation for both patients and therapists. Patient and therapist interactions may be facilitated and necessary treatment programs may be more easily implemented if pain was not a hindering factor. The patient who perceives decreased levels of pain may demonstrate increased participation in his or her rehabilitation program. As a result of increased patient participation, effects of therapy may be seen more rapidly and the overall length of the rehabilitation period may be reduced.

For these reasons, educational programs dealing with techniques of pain management would appear essential at both the academic and clinical levels. Therapists who are knowledgeable in the use of new and effective modalities would be able to share their knowledge with other clinicians and students through educational experiences in the classroom, workshops, publications, etc. Application of learned concepts would then become the responsibility of both therapist and patient in the clinical setting. It seems apparent that education in effective techniques in the suppression of pain may be of considerable value and of universal therapeutic significance.

Summary

Pain is a phenomenon comprised of physiological and psychological dimensions. To enhance understanding of the construct of pain, review of the construct of anxiety and its relationship to pain is generally recommended. In addition to review of the anxiety relationship, study of specific physiological indicators of pain may be beneficial in understanding the pain phenomenon.

Techniques which foster suppression of pain are invaluable to the medical and dental professions. One such technique recently introduced to these professions is audioanalgesia, the suppression of pain through sound.

Of particular concern in this investigation was the potential suppression of pain for adult patients with burns during post-acute rehabilitative exercise. Audioanalgesia and its effects on subjective levels of pain and anxiety as reported by patients, as well as peripheral body temperature were examined. Interrelationships of these variables were also the focus of this study.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

To investigate the effects of audioanalgesia during rehabilitative therapy with burn patients, it is necessary to examine a number of related components. This chapter examines the concepts of pain and anxiety and their interrelationships. Pain responses and methods of measuring pain are also reviewed. Conventional exercise, and therapeutic exercise as it relates to burn rehabilitation is acknowledged. Pain management strategies are reviewed and ultimately a discussion of audioanalgesia and its clinical applications follows.

Pain

The origins and mysteries of pain have intrigued mankind for centuries. Today, there is yet to be a universally accepted definition or explanation for the complex pain phenomenon. There tends to be agreement on selected facets of the pain experience, however, other aspects of the pain experience remain quite controversial and mystifying.

Sternbach (1976) defined the word "pain" as an abstraction used to refer to a great variety of different feelings which have little in common except for the quality of physical hurt. In a sense, he explained, the word is like "beauty," which has no existence of its own, but an element common to a variety of specific experiences, and ultimately defined only by the experiencer. Pain has a unique, distinctly unpleasant, affective quality that differentiates it from sensory experiences such as sight, hearing, and touch. It becomes overwhelming, demands immediate attention, and disrupts ongoing behavior and thought (Melzack, 1973). Stimuli that arouse pain, according to Weisenberg (1975), are mechanical (pressure), electrical (shock), thermal (radiant heat), and chemical (bradykinin). Responses measured are verbal, behavioral and physiological. The pain response in humans (Melzack, 1983) consists of two major groups of components, often labled sensory--anatomical, physiological and chemical factors; and psychological--psychosocial and affective variables.

In an attempt to comprehend the pain phenomenon, a number of theories have arisen. Over time, these theories have undergone evolutionary changes based on accumulation of new experimental evidence as well as on imaginative assumptions derived from clinical and psychological observations. Both neurophysiological and psychological theories of pain exist. The most frequently reviewed neurophysiological theories are the specificity theory, the pattern theory, and the gate-control theory.

Specificity Theory

The specificity theory of pain (Gatchel & Baum, 1983; Kessler & Hertling, 1983; Melzack, 1983; Weisenberg, 1975) as proposed by Von Frey in 1894 assumed the existence of specific sensory receptors which were responsible for transmission of sensations such as touch, temperature, and pain. These sensory receptors were thought to be structurally different and sensitive to specific kinds of stimulation. The receptors believed to be associated with the pain sensation were assumed to be free nerve endings. Pain was therefore viewed as having specific central and peripheral mechanisms similar to those of other bodily senses.

This theory, which proposed a specific and direct stimulus-response chain paid little attention to central pain modulation (the influence of spinal cord or brain on input) and considered only the sensory experience of pain. It ignored the associated motor, emotional, or psychological responses to pain.

Pattern Theory

An alternative to Von Frey's specificity theory of pain was the pattern theory of pain (Gatchel & Baum, 1983; Kessler & Hertling, 1983; Melzack, 1983; Weisenberg, 1975). This theory emphasized that it is the anatomical variation in fiber size over which afferent impulses travel that leads to temporal and spatial summation of input in central receiving areas.

The theory postulated that a specialized system exists that combines and modifies all peripheral sensory input before it ascends to higher brain centers, thereby modifying the nature of the resultant sensation. The theory also proposed that all stimulus information from the periphery must summate in the central nervous system to allow determination and execution of a proper response.

Researchers indicate weaknesses in this theory to be that pain is again considered to be largely a sensory phenomenon and little reference is made to associated affective phenomena. It does not account for nerve-fiber specialization and the influence of central modulation of input is not considered.

Gate-Control Theory

In 1965, Melzack and Wall proposed the gate-control theory of pain (Gatchel & Baum, 1983; Kessler & Hertling, 1983; Melzack, 1983; Weisenberg, 1975). This theory assumed that a number of structures within the central nervous system contribute to pain. It is the interplay between these structures that is critical in determining if, and to what extent a specific stimulus leads to pain. Pain is not viewed as a "straight-through" transmission of impulses from the skin to the brain.

In basic terms, this theory proposed the presence of a neurophysiological mechanism in the dorsal horns of the spinal cord which serves as a gate-like function, increasing or decreasing the flow and transmission of nerve impulses from peripheral fibers to the central nervous system. Before pain perception is evoked, the sensory input is subjected to the modulating influence of the gate. It is thought that the activity in large-diameter fibers (A-beta fibers) and small-diameter fibers (A-delta and C fibers), as well as descending efferent influences from the brain determines the degree to which the gate increases or decreases sensory transmission.

The gate-control theory is able to account for many pain phenomenon. This model also suggests that psychological factors such as past experience, attention, and emotion influence pain response and perception by acting on the gate-control system. For example, central activities such as anxiety or excitement may open or close the gate for all inputs at any site of the body, whereas others involve selective, localized gate activity.

The gate-control theory is supported by both practical and experimental evidence. As the model suggests, control of pain may be achieved by enhancing large-fiber input. Large-fiber input occurs, for example, when an individual rubs an injured area after hitting it accidently on a sharp table corner. Physical therapists use a number of modalities to decrease pain by increasing large-fiber input. Hot packs, whirlpools, massage, vibrators, transcutaneous nerve stimulation, and joint mobilization all act to increase large-fiber input, thus decreasing nociceptive transmission.

Psychological Theories

Over time, three main psychological theories of pain have developed (Weisenberg, 1975). The first suggests that pain is a consequence of hostility. The second implies that pain arises in patients of a certain personality-type who use the complaint as a means of communication. The third theory argues that pain arises as a consequence of a threat to the integrity of the body, either for objective or emotional reasons.

All three theories attempt to deal with pain as a psychological event in relation to those other psychological events which cause it. Research on the psychological components of the pain experience has emphasized the significance of cognitive and affective aspects of pain. The subjective experience of pain becomes more clear if psychological factors of pain are considered along with the physiological dimensions of pain.

In order to establish a realistic conception of pain, it would seem that a meshing of both physiological and psychological theories should occur. The understanding that pain involves much more than a simple relay of sensory input is of primary importance clinically. Psychological factors including past experience, culture, personality, emotional state, age, motivation, role expectations and learned behavior can all contribute to modulation of nociceptive stimuli and can influence the final pain experience (Kessler & Hertling, 1983; Weisenberg, 1975).

Cultural and Other Factors

The reaction to pain has been shown to be manipulatable and affected by cultural and other background factors (Weisenberg, 1975). Since pain is a private, ambiguous situation, comparison with others helps to determine what reactions are appropriate. People learn to express their reactions by observing the reactions of others. One chooses models who are similar to oneself, whereas one rejects those who are too divergent. The first important source of comparison is the family which transmits the cultural norms to its children.

A number of studies (Dick-Read, 1959; Melzack, 1983; Zbrowski, 1969) demonstrated that underlying attitudes and anxiety reactions seem to be the major sources of the cultural differences in pain tolerance. Weisenberg (1975) noted that in one study involving radiant heat stimulation to the forehead, blacks demonstrated a lower pain perception threshold and a lower pain reaction than white North Europeans. The differences in pain responses between the groups was concluded to be unlikely due to pigmentation. The differences in pain sensitivity and pain tolerance was concluded to be due to ethnic factors.

There is strong experimental evidence that attitudinal factors tend to influence the pain response of different cultural groups. The demonstration that pain thresholds reflect decision processes in addition to sensory input has forced a reevaluation of studies in which experimental pain thresholds have been reported to differ with age, sex, ethnocultural differences, personality and anxiety. People bring their own attitudes into a study (Melzack, 1983). Pain thresholds do differ in different groups, but are these differences neurosensory or attitudinal? Another fact to consider would be when two pain thresholds are the same, this does not necessarily mean that the discriminability and criteria are the same for the two.

A study of a group of Sherpas in Nepal revealed that their ability to discriminate electrical stimuli was the same as that of Western controls, however, the Sherpas had a much higher pain threshold. This was thought to be due to a culturally and climatically determined stoical pain report criterion (Melzack, 1983). This study suggested that many of the differences in pain thresholds reported to exist among various ethnic, religious, and racial groups are due to differences in the criterion for reporting pain, and not to the sensory experience itself.

Clinical Factors

Before concluding a discussion on pain, the issue of clinical pain deserves attention. In the laboratory, pain measurement usually involves more of the sensory components whereas in clinical practice pain assessment generally involves a significant proportion of the affective components (Melzack, 1983). In clinical situations, pain needs to be viewed from the point of view of the patient (Fordyce, 1976). Fordyce (1976) indicated most scientific studies of pain have focused on neurophysiological events. There is a tendency to accord to the neurophysiological events a greater sense of importance. They seem to be more real. The subjective experience and the related functional impairments (pain from the point of view of the patient) are sometimes viewed as unfortunate by-products. These by-products are further influenced or distorted by psychic factors to the extent that some of what patients may report as pain is not really pain at all but something else. Some or all of their pain is not real; it is called psychic, a term that ordinarily connotes that the pain is thought to be imagined or unreal. Therefore, according to Fordyce (1976), pain is not simply a neurophysiological event, nor is it simply what a patient states. This is because the patient's knowledge and perceptions will limit his or her ability to discriminate well enough what is going on. Patient reports of pain will be subject to influence and distortion by factors such as ongoing cortical activity, the immediate stimulus situation, and prior experience.

Clinical pain usually lacks a definitely known and manipulatable stimulus, and thus direct measurement techniques are preferred. Clinical pain should be separated into acute and chronic pain states. Acute pain refers to pain usually associated with tissue damage, in which the pain decreases as the tissue heals--the traditional medical concept. Chronic pain, on the other hand, is pain that persists usually for six months or more and no longer signals real or impending tissue damage (Melzack, 1983). Clinical pain is often persistent, unbearable, beyond the patient's control, and accompanied by high levels of anxiety. Melzack (1983) noted in a study by Malow involving threat of shock (high anxiety) and no shock (low anxiety), it was found that induced state anxiety decreased discriminability and raised the pain report criterion, changes suggestive of analgesia, perhaps owing to attentional effects.

Anticipation of pain and resulting anxiety are basic ingredients in the reaction component of the pain experience, whether the pain is pathological or experimental (Weisenberg, 1975). When anxiety about pain is reduced, the subjective experience of pain can be reduced.

Anxiety

Anxiety is a difficult concept to define because it refers to subjective feelings as well as overt behavioral characteristics. In spite of the difficulty with precise definition, the concept of anxiety has occupied an important place in personality theories and research.

Freud (1936) viewed anxiety as an unpleasant affective state characterized by apprehension, indefiniteness, and anxious expectation. He noted that anxiety manifests two features: the expectation of a trauma and a reproduction of an old event which was experienced as traumatic. According to Freud (1936), the primal source of anxiety is the separation of the child from its mother. The purpose of anxiety is that of self-preservation in the form of a signal of danger. Freud differentiated fear from anxiety: in fear, the response is directed to an object, while anxiety ignores the object and refers to the condition of the individual.

Rogers (1951) referred to anxiety as a feeling of tension and unpleasantness. Anxiety occurs when the person becomes aware of responses that are inconsistent with his organized concept of self. The individual will attempt to avoid the experience of anxiety by denying his awareness of the inconsistent response or by distorting the response to render it acceptable.

Wolpe (1973) indicated that anxiety is a conditioned fear reaction brought about by the association of one or more occasions of an initially neutral stimulus with a physically or psychologically painful event. If the trauma is sufficiently intense and the person particularly vulnerable, only one such experience may be required to establish an anxiety reaction of great strength.

Like other theorists, Sternbach (1974) concurred that anxiety is either that type concerning a threatened separation from an important person, or that type concerning a threatened injury. Anxiety, therefore is the effect that occurs when an individual anticipates what might happen.

Although there are many other differences in the theorists' conceptions of anxiety, there is the common theme that anxiety may be innately elicited by intense bodily disturbances, response conflicts, and situations of danger.

Cattell and Scheier (1958) stated that theories of anxiety should be based on valid and reliable instrument measurement. In implementing this idea, they discovered with their factor analytic approach that anxiety of two types appeared to exist, i.e. anxiety as a transitory state and anxiety as a relatively stable personality component.

Based on Cattell's position, Spielberger (1966, 1972, 1975) developed the Trait-State Anxiety theory. The basis of the theory is that the persons high in the predispositional factor (A-Trait) have a greater tendency to perceive situations as threatening than persons low in A-Trait, and will respond to threatening situations experientially with state (A-State) elevations of greater intensity. Spielberger (1972) defined the concepts as follows:

> State anxiety (A-State) may be conceptualized as a transitory emotional state or condition of the human organism that varies in intensity and fluctuates over time.
>
> Trait anxiety (A-Trait) refers to relatively stable individual differences in anxiety proneness, that is, to perceive a wide range of stimulus situations as dangerous or threatening, and is the tendency to respond to such threats with A-State reactions. (p.39)

To measure state and trait anxiety according to these definitions, Speilberger, Gorsuch, and Lushene (1970) constructed the State-Trait Anxiety Inventory (STAI). Separate scales of 20 items each were developed for the measurement of both constructs in adults. Since its development, research with the STAI has indicated that individual differences in anxiety proneness, A-Trait, are relatively stable. State anxiety, A-State, appears to be situational and fluctuates with various stresses (Auerbach, 1973; Newmark, 1972; Spielberger, 1972; Wilson, 1974). Situations involving threat to ego or to self-esteem have been found to evoke larger increases in state anxiety for individuals with high levels of trait anxiety than for individuals with low levels of trait anxiety (Auerbach, 1973; Hodges, 1968; McAdoo, 1971).

Studies using the STAI with patients in surgical situations lend support to the evidence that A-Trait levels do not relate differentially to A-State levels in situations involving physical danger. Most evidence supports that A-Trait remains relatively impervious to stress, while A-State levels become elevated in anticipation of treatment itself. This suggests that attempts at reducing the anxiety experiences during a treatment procedure must also address the preliminary anxiety experiences in anticipation of the procedure.

Set or anticipation is another aspect of attention that is capable of influencing whether and how pain is experienced. What one is set to experience, the anticipation of what is to follow, can itself modulate considerably the nature of the ensuing experience (Fordyce, 1976).

Pain and Anxiety Relationship

Research suggests an intense relationship between pain and anxiety. Sternbach (1974) indicated that the effect which we historically associate with experiences of acute pain is anxiety. He also suggested that as pain increases so does anxiety, until, at a specific point, something is done to obtain relief before the pain becomes very severe.

Other lines of evidence illustrate that anxiety can be expected to play roles in the perception and response to pain. Fordyce (1976) cited that in many situations, the sufferer identifies what is experienced as pain when it may at least in part, be some other form of emotional distress. For example, anxiety, depression, or pain may be considered feelings of distress which belong to the same response class. When one member of this class of responses is elicited by adequate stimulation, other members of the response class may be experienced due to the nature of associative processes. What is perceived as pain arising from suspected body damage may instead be anxiety relating to some status threat. Ongoing cortical activity such as emotional state often complicates efforts to understand why a person signals he is experiencing pain.

Upon examination of many studies dealing with the psychological aspects of pain, a distinct relationship continues to be noted between the constructs of anxiety and pain. Studies of cultural influence tend to support this premise. Fordyce (1976) cited a study of relationships between Anglo-American and Mexican-American subjects in regard to responses to chronic pain. His findings demonstrated what other studies and anthropological observations have indicated--there are often to be found identifiable differences in the magnitude of pain responses in relation to given stimuli, as a function of cultural identity.

Zborowski (1969) and Weisenberg (1975) have investigated differences in reactions to pain between various social and cultural groups. Both concluded that underlying attitudes and anxiety seem to be the major sources of differences in pain tolerance among the groups studied.

In a study of black, white, and Puerto Rican dental patients, Weisenberg, Kreindler, Schachat and Werboff (1975) found significant differences in trait anxiety, anxiety relating to the dental situation, and attitudes about dealing with pain. Puerto Rican patients were highest in dental anxiety. To explain the origins of these differences in reactions to pain, Weisenberg (1975) theorized that people learn to express their reactions by observing and modeling after the reactions of those around them. Thus, developmentally, the child learns acceptable and appropriate expressions of pain from his family and peers.

Another illustration demonstrating the cultural influence on the perception of pain is that of childbirth. Dick-Read (1959) discussed the relationship between a woman's expectations of the experience of childbirth and the amount of pain she perceives. A woman's expectation of pain increases anxiety which then fosters muscle tension and thus exacerbates the pain and cyclically induces more anxiety.

Many other studies also lend support to the existence of a pain-anxiety relationship. Regardless of the specific study, much research incorporates the attitude of Schacham and Daut (1981) that anxiety can be part of or can amplify the pain experience. Szasz (1957) also proposed that reactions to the acute pain situation demonstrates that as pain increases so does anxiety. In a review of the laboratory studies in which pain was artificially manipulated and correlated with anxiety measures, Sternbach (1968) concluded that the higher the level of anxiety, the greater the reaction to the painful stimulation. Fordyce (1976) cited a similar study in which subjects experiencing experimentally induced anxiety feel electric shock or burning heat to be more painful. Reduction of the anxiety results in lowered intensity of perceived pain. It has also been shown that morphine reduces pain if the anxiety level is high but has no effect if anxiety is low (Fordyce, 1976).

Killough (1977) used the Pain Apperception Test and the Subjective Units of Disturbance scale as pain measures and the STAI to investigate the pain-anxiety relationship during the surgical process of hydrotherapy debridement with burn patients. He administered all instruments during an initial test period and then measured state anxiety and pain levels during three debridement situations. He reported no correlation between A-State and pain during the initial test period, but did find significant positive correlations between these factors across the debridement test periods.

Although studies have generated conflicting results, there appears to be evidence of a relationship between pain and anxiety in both laboratory and surgical situations. This relationship seems to indicate that the greater the anxiety, the greater will be the perception of pain. The studies demonstrating cultural and attitudinal differences in the pain experience imply that expectations of pain and reaction to pain are learned responses. This suggests the possibility that new responses can be learned.

Pain Response and Measurement Scales

There is perhaps as wide of variety of responses to pain as there are methods of measuring or recording pain. In a discussion of pain response and measurement, there are many considerations. Initially it is important to differentiate between pain perception and pain reaction. Perception of pain can be defined in terms of quality and intensity while reaction to pain takes on symptoms such as tachycardia, anxiety, fear and panic (Rich, 1980).

The word "pain" is frequently used, especially in research to refer to a class of behaviors which operate to protect the organism from harm or to enlist aid in effecting relief. Pain behaviors may fall in the verbal, physical, or psychological categories (Sternbach, 1974).

At present, there is no single physiological indicator of pain which is accepted as varying consistently, or in an orderly way with the degree of pain (Elton, Burrows & Stanley, 1979). Historically, however, a number of physiological responses have been associated with the pain experience. According to Selye (1950), pain is a prime example of a stressor. Pain and other stressors, as Selye described, can be shown to stimulate the sympathetic nervous system and to increase the electrical activity of the nuclei within the hypothalamus. It can also increase levels of circulating gonadal hormones, growth hormone, anti-diuretic hormone and thyroid-stimulating hormone, thus affecting regulation of local and systemic blood pressure, protein synthesis, blood levels of glucose and fatty acids and energy metabolism (Edington & Edgerton, 1976).

Skin temperature may also be affected by pain. Abram, Asiddao and Reynolds (1980) noted in a study involving transcutaneous electrical stimulation that pain-induced vasoconstriction was observed. On the other hand, vasodilation occurred secondary to pain relief and diminished sympathetic tone was evidenced by increased skin temperature.

Traditional measurements of heart and respiration rate, and galvanic skin responses are thought to reflect the global state of arousal of an individual. Many researchers, however agree that these measures cannot be specifically correlated with the experience of pain and that the verbal report of pain by the patient is generally more specific and sensitive than the measurement of the autonomic responses (Elton, et al., 1979).

Other studies also favor the verbal, or subjective report of pain. Relationships between verbal report and physiological indicators of pain, using hypnosis as one of the key experimental variables has been studied (Fordyce, 1976). It was shown that verbal report measures yielded finer stimulus discriminations and were more systematically correlated with stimulus variations than the physiological measures.

Measurement of physiological responses associated with pain is relative to the specific response being measured. In most cases, standardized procedures and equipment should be used when measuring physiological responses such as heart rate, blood pressure, respiration, pulse, galvanic skin response and skin temperature. Observation sites or placement sites for equipment such as cuffs, electrodes and other feedback devices or monitors will vary according to the nature of the study. Measurement of physiological responses has been shown to demonstrate a relationship to the pain experience in many studies. Physiological measures are often desirable and valuable due to their objective nature.

Reports of pain, on the other hand, are often considered more difficult to measure due to their subjective nature. These types of reporting systems generally include visual observation by others of specified pain behaviors and verbal reports of pain by the individual. A specific or concrete response is not measureable in the same manner for reported pain as it is with measurement of physiological response to pain. Subjective measurement is based upon judgement and is highly individualized.

Three systems, descriptions, numbers and a visual analog are traditionally used for expression of pain severity (Huskisson, 1982). Although graphic rating scales and visual analog scales have been used for subjective measures in psychology and education since the early part of this century (Houde, 1982), it is only in the past decade or so that these tools have been applied to the measurement of clinical pain.

The simple descriptive pain rating scale consists of four or five points along a continuum with corresponding verbal descriptors such as none, mild, moderate, severe and very severe (Downie, Leatham, Rhind, Wright, Branco & Anderson, 1978). There are several problems inherent in using this scale. Huskisson (1982) indicated there are not enough descriptions available to be placed regularly in the same rank order. Downie et al. (1978) believed there is lack of sensitivity for detecting relatively small changes. Sriwatanakul, Kelvie and Lasagna (1982) cited a major problem being that words commonly used in analgesic studies to describe quantity of pain do not have the same meanings for all participants.

Numerical pain rating scales generally consist of a numbered scale from 0-20 or the like. The subject is asked to respond to the intensity of the pain experience with zero equating to no pain. There appears to be improvement in discrimination of pain using the numerical pain rating scale in comparison to the descriptive scale (Downie et al., 1978).

Disadvantages of the descriptive and numerical pain scales can be partially overcome by using a visual analog scale. Both a visual analog and verbal rating scale were used by Ohnhaus and Adler (1975) in a double-blind, complete crossover study of analgesics in clinical pain, and a high correlation was found between the two scales. It is thought, however, that verbal scales tend to distort by forcing patients to choose a category whereas the visual analog scale more closely assesses the patient's experience.

The visual analog is a line which is taken to represent the continuum of pain. Each end is defined as the extreme of the pain experience. Patients are generally requested to mark the scale at the point corresponding to his or her pain experience (Huskisson, 1982).

The design of the visual analog scale should be consistent. An analog scale with only descriptors at the endpoints is preferred. Visual analog scales with descriptors at intervals along the line will give a distribution of results predominantly at points corresponding to the descriptions (Huskisson, 1982).

Scales without descriptors can be used in the horizontal or vertical position and the results are similar. However, the scores from horizontal scales tend to be slightly lower than the vertical ones (Scott & Huskisson, 1979). It is therefore essential that the scale should remain identical throughout a particular study.

Huskisson (1982) indicated there is an excellent correlation between repeated measurements of pain severity on a visual analog scale. Visual analog scales provide the patient with a sensitive reproducible method of expressing pain severity. Results correlate well with other methods of measuring pain.

Regardless of the particular pain rating system selected for use, it should be remembered that pain varies with the time of day so the timing of measurements must be standardized (Huskisson, 1982). Another consideration in studying the pain phenomenon would be the use of a variety of pain measurement tools in a single study. Kenner and Achterberg (1983) supported this argument citing significant findings in pain relief as observed by the measures of subjective pain, state anxiety and peripheral body temperatures in pre- and post-treatment measures. The subjective pain reports as recorded using the SUD (subjective units of discomfort) scale, were significant at the $p < .001$ level. State anxiety measures were statistically significant at the $p < .01$ level. Peripheral body temperatures were statistically significant for all groups at the $p < .001$ level.

Problems have been encountered in most studies of pain. Even if the same treatment is given, patients may use their own coping measures and therefore feel less pain. Since pain is merely physical and not objective, multiple measures must be used.

Exercise

Pain is experienced by many individuals during various types of exercise. It is often difficult to assess the pain associated with exercise since identical forms of exercise elicit varied responses in different people. At different times, varied responses to identical exercise may even be noted within the same individual (Edington & Edgerton, 1976).

Exercise is an important component of the normal activity of all persons. It is in fact defined as the act of performing a physical activity (Edington & Edgerton, 1976). If the effects of activity on the human body were examined, it would be determined that the specific physical requirements of specific exercises regulate specific biological responses.

Exercise is traditionally associated with increased metabolism and increased performance of skeletal muscle. The increased activity in skeletal muscle ultimately results in an increase in skeletal muscle blood flow. This increase in blood flow to the skeletal muscle causes a change in peripheral vascular resistance which is sensed and responded to by the circulation in such a way that the blood flow demands are met (Lowenthal, Bharadwaja & Oaks, 1979).

It is not so much the duration of exercise but the intensity of the work that brings about the changes in peripheral circulation. Exhausting exercise, for example, causes severe vasoconstriction in the skin and slowing of blood flow because of sympathetic stimulation, while mild exercise has no influence on the small vessels (Lowenthal et al., 1979).

Edington and Edgerton (1976) indicated that in response to exercise, redistribution of blood flow within a limb may occur without an overall change in blood flow. For example, total blood flow to the forearm is unchanged during moderately severe leg exercise, but flow to the forearm skin increases at the expense of forearm muscular exercise.

In addition to vasoregulation, sympathetic nervous system activity during exercise increases. This is evidenced by increased pulse rate, increased heart rate, rise in blood pressure, increased respiration, hyperemia, heat dissipation by sweating, and skin temperature changes among others.

Therapeutic exercise should be differentiated from conventional exercise as just described. Lowenthal et al. (1979) discussed therapeutic exercise as a prescription of bodily movement to correct an impairment, improve musculoskeletal function, or maintain a state of well-being.

Therapeutic exercise is a vital component in successful rehabilitation of the patient with musculoskeletal disorders such as contracture resulting from burn injury. To appreciate the concept of exercise with this type of patient, it is necessary to have a basic understanding of the burn injury and its effect on muscle function. It is also important to understand exercise treatment goals and principles.

Some of the major consequences of burn injury include scar contracture, deformity, muscle atrophy, loss of motion, strength and functional ability. Patient immobilization and the inelastic nature of the newly healing tissue are perhaps the primary causes of these deficits.

Long-term immobilization and comfortable body positioning pose many threats to the burn patient. Resulting motion loss is primarily due to joint capsular contractures and infiltration of joints and cartilage by fibrous tissue. Demineralization of bones and loss of bone-synthesizing activity also occurs from inactivity (Edington & Edgerton, 1976). Atrophy of muscles occurs during immobilization and depends on: the degree of disuse compared with normal usage, type of muscle fiber, duration of immobilization and the fixed muscle length. Muscles immobilized in shorter than normal positions atrophy faster than muscles fixed in a stretched position. Atrophied muscles are more susceptible to fatigue than they were prior to atrophy (Edington & Edgerton, 1976). Manipulation of immobilized joints reduces the magnitude of these musculoskeletal problems. Exercise goals in treating musculoskeletal disorders should involve developing appropriate responses and acceptable patterns of movement, strength, and endurance which lead to accomplished functional ability.

The quality of muscle function primarily addressed in burn rehabilitative exercise is that of elasticity. Both physiological and mechanical elasticity influence muscle function. Physiological elasticity is defined as the ability of the muscle to surrender contraction, or relax, and mechanical elasticity as the ability of the muscle to yield to passive stretching (Lowenthal et al., 1979).

When implementing a treatment program, one should adhere to Rusk's general exercise principles (1958). These include: placing the patient in a comfortable position, stabilizing proximal joints to eliminate undesired motion; short, frequent rather than prolonged treatment sessions; sufficient intensity; patient involvement; and evaluation (Lowenthal et al., 1979).

Physiological response to therapeutic exercise, particularly with burn patients, is not well documented. In comparison to the conventional or more physical type of exercise, sustained stretching exercise with burn patients should most likely be considered a separate entity. Physiological responses to stretching exercise might be more appropriately related to the emotional aspects rather than the physical aspects of the exercise due to the passive nature of this type of exercise.

The degree of anticipation, or the extent of the emotional involvement prior to exercise varies from one individual to another. Edington and Edgerton (1976) supported this indicating there are individuals who acknowledge that they will shortly engage in physical activity, but are not particularly concerned, and there are other individuals who for one reason or another become overexcited, worried, sick, or scared. The first individual demonstrates minimal endocrine response whereas the endocrine response of the latter individual is excessive. During the anticipation phase, a release of ACTH and cortisol is expected due to a general stress reaction. Sympathetic nervous stimulation causes release of norepinephrine. The combination of reactions decreases protein synthesis in the muscle and increases blood sugar, gluconeogenesis in the liver, sweat gland activity, strength of heart beat, heart rate, and blood pressure (Edington & Edgerton, 1976).

With probable increased sympathetic nervous system activity, associated pain responses may occur during therapeutic exercise. This would particularly be true with burn patients. As indicated previously, anticipation and emotional involvement may elicit variable responses in different individuals. Associative reactions with past painful procedures during the early course of burn care, as well as the direct pain associated with tissue trauma and healing, often creates attitudes of apprehension and resistance towards exercise with the patient in the post-acute phase of rehabilitation. Resistance of newly healing or healed tissues to stretch during therapeutic exercise may also induce a painful response. The patient's pain reaction, in both the physiological and psychological sense may be quite varied as indicated earlier in this chapter. Because of the magnitude of the pain experience throughout the course of burn rehabilitation, pain management methods are under continual investigation.

Pain Management Strategies

Non-pharmacological methods of pain control are quite varied. A number of studies have revealed various conditions that alter behavioral and psychophysical responses to pain including placebos, hypnosis, non-painful somatosensory stimulation, redirection of attention, and auditory stimulation (Lavine, Buchsbaum & Poncy, 1976). Behavior modification, acupuncture, biofeedback, cognitive strategies such as positive imagery, and relaxation have also been effective in controlling pain (Gatchel & Baum, 1983). Additional therapeutic practices which include a variety of psychophysiological methods for making use of bodily processes to reduce tension and anxiety include: yoga, T'ai Chi, and Zen awareness training; bioenergetics (body movements and verbalization used to release blocked or repressed energy and reintegrate body and mind); dance therapy; massage; acupressure and Jacobson Relaxation (Kessler & Hertling, 1983). Strong suggestion, faith in the physician and his techniques have been demonstrated to diminish both pain and anxiety (Weisenberg, 1975).

Additional experimental data indicated that pain can be reduced. Some methods would include minimizing subjects' anxiety, leading subjects to expect that they have the ability to control pain, asking subjects to imagine situations that are incompatible with the experience of pain, distracting the subjects, and administering suggestions for pain reduction (Weisenberg, 1975).

Regardless of the specific technique employed, the primary objective in pain control should be direction of attention to re-establishment of the body's homeostasis. Physiological responses thought of as conducive to re-establishment of the body's homeostasis include: lowered blood pressure, increased blood flow, decreased heart and respiratory rate, intensification of the alpha response, and a general decrease in metabolic processes indicated by decreased oxygen consumption and carbon dioxide production (Wolpe, 1958).

In the effort to alter the physiological responses of the individual experiencing pain, the psychological dimension of pain must also be addressed since pain is comprised of physiologic and psychologic aspects. Physical aspects of the pain phenomenon are often not as severe as anticipated while the emotional aspects may be more severe (Kenner & Achterberg, 1983). Each aspect has its own causes and characteristics but appears to be dependent upon the other. Therefore, treatment in one realm alters the characteristics of that realm, affecting the other realm, thereby influencing the overall pain experience.

The experience of pain is usually closely intermingled with fear, anxiety, worry and other emotions. Anxiety and fear are known to enhance greatly the perception of pain. It would therefore seem reasonable that procedures which diminish the level of anxiety and fear would also decrease the level of perceived pain.

It has been determined that a person cannot be relaxed and experience anxiety simultaneously since it is physiologically impossible for these states to co-exist (Wolpe, 1958). Therefore, based upon the already established relationship between anxiety and pain, if the person is relaxed and not anxious, his perceived pain should be diminished.

In the vicious cycle of anxiety, fear and pain, emotional reactions influence the individual physiologically. To break this cycle, Locsin

(1981) concurred that attention to pain should be distracted by refocusing it to a pleasant sensory stimulus, particularly music.

The psychological or cortical process of attention exerts considerable influence on the perception of pain stimuli as well as on pain behaviors. It is well recognized that presentation of attention demanding stimuli can provide an effective distraction effect, thereby diminishing the perception of pain (Fordyce, 1976). Conversely, exposure to reduced distraction may increase the pain experience.

Available data suggested that a wide variety of distractions are effective in reducing pain (Weisenberg, 1975). These include: distraction by listening to an interesting tape recording, listening to an interesting tape recorded story, adding numbers aloud, verbalizing the sensations aloud, self-pacing with a clock, and observing a series of slides. The distraction can either take the form of external stimulation or instructing the subjects to direct their attention to something besides the pain-producing stimulus.

Fordyce (1976) explained how Melzack and Wall's gate-control theory of pain provides a neurophysiological rationale for how this pain reduction strategy might work. He indicated that counter-stimulation which increases large A-fiber input, thereby changing the large-to-small fiber ratio, may inhibit transmission of a pain sensation. Also stated is the fact that counter-stimulation mobilizes central neural mechanisms, which may exercise influence over the gate and thereby over the pain experience. Distraction and other pain inhibitory effects may then occur.

It is a comforting thought that respondent pain may be subject to reduction in several non-pharmacological ways, apart from that of modifying the source of stimulation. Continued studies should further enhance knowledge and education in the area of pain control strategies.

Audioanalgesia

Although the precise relationship between pain and anxiety has not been established, it is generally accepted that pain is cognitively mediated (Melzack & Wall, 1970). Sternbach (1976) noted that pain tolerance, the maximum amount of pain a person can tolerate, can be increased by motivation, anxiety reduction and distraction. Music works as a distraction medium and is important in breaking the cycle of pain (Vista & Faurot, 1978).

Behavioral and psychophysical responses to pain stimuli have been reduced under experimental conditions by auditory stimulation (Gardner, Licklider & Weisz, 1960). The concentration/attention aspect of listening to music can divert preoccupation with pain and the discomfort of environmental realities to more pleasant memories. It occupies one's mind with something familiar, soothing and preferred (Locsin, 1981).

Physiological effects using music have also been established. Music has been found to decrease bodily metabolism, increase or decrease muscular energy, accelerate respiration, affect the volume of pulse and blood pressure and lower the threshold for sensory secretions (Guyton, 1971).

Audioanalgesia, the use of music for pain relief, differs from pharmacological methods of pain relief in several ways. In an article by Rich (1980) this difference is explained. When a local anesthetic injection is used for pain control, the nerve stimulus is blocked from conducting along the sensory nerve fiber to the brain for recognition of pain and production of a response. The cerebrum does not receive the pain impulse, so no return message is sent back along the motor nerve. Audioanalgesia, on the other hand, acts upon the autonomic nervous system (both parasympathetic and sympathetic) which is responsible for automatic body functions such as regulating visceral organs, circulation, respiration, digestion, excretion, and reproduction. The sympathetic system functions constantly and increases its activity during times of stress. The parasympathetic system is concerned with conservation and restoration of energy and performs this duty by functions such as slowing the heart rate and the lowering of blood pressure.

Gardner et al. (1960) explained the effects of audioanalgesia indicating that parts of the auditory and pain systems come together in several regions of the reticular formation and lower thalamus in the brain. The interactions between the two systems are largely inhibitory. Direct pain suppression and pain reduction through relaxation, reduction of anxiety, and diversion of attention, occurs because acoustic stimulation decreases the gain of pain relays upon which branches of the auditory system impinge.

Rich (1980) explained that audioanalgesia is effective due to stimulation of the large fibers of the nervous system by sound which blocks the transmission of pain from the small fibers to the brain. The gate-control theory proposes that pain can be influenced by cognitive activities such as anxiety, attention and suggestion. Since anxiety contributes to pain enhancement, the relief of anxiety should be one of the methods of pain reduction. Distraction elicits responses that are incompatible with pain responses, and is therefore an effective method of pain relief through such distraction.

Weisenberg (1975) concurred indicating that auditory stimulation does not abolish pain. What it does, however, is to divert attention away from pain. Audioanalgesia sedation modifies the situation or conditions the mind into a calm, restful state. Audioanalgesia attempts to create a mood and environment comfortable to the patient.

In a study of patients treated by eight dentists in the Boston area, sound stimulation was the only analgesic agent required in approximately 90% of five thousand operations (Gardner et al., 1960). In another study involving dental procedures, data indicated that audioanalgesia can effectively alter the pain threshold and tolerance level. The results were interpreted in terms of anxiety reduction in which anticipation or fear of pain was dispelled and the noxious stimulation was experienced as less painful (Morosko, 1960).

Audioanalgesia has also been found effective in other studies as well as in clinical medical situations. In over two-thirds of applications to patients whose pain sources included toenail removal, labor and childbirth, left heart catheterization, and polyp removal, audioanalgesia was effective (Gardner et al., 1960). Gulledge and Kline (1981) reported music via stereophonic headphones provided relaxation and reduced the need for perenteral sedative medication for patients undergoing cataract surgery under local anesthesia. In 1978, Wolfe reported when music was used with patients during exercise, it functioned as an effective diversional tool to aid in inhibiting the perception of chronic pain. Locsin (1981) studied the use of music with post-operative patients. This study revealed that instrumental music was generally preferred. During the first 48 hours after surgery, there was a significant difference in musculoskeletal, verbal and physiological-autonomic pain reactions, decreased overt pain reactions, fewer increases in blood pressures and pulse rates and less use of pain relief medications.

Today, audioanalgesia has extended its use to the treatment of pain associated with cancer. It seems in searching for methods for pain control other than drugs, music seems to reach patients who do not respond to anything else (Witt, 1984). Where traditional treatments often fail, music can help terminal cancer patients forget their pain and cope with death.

Anxiety and/or pain can be the cause, as well as the result of something happening to the body to upset homeostasis. Using music as a stimulus restores natural rhythm and allays anxiety. There are many examples of the effects of music on body processes. Stirring patriotic type music increases cerebral and peripheral circulation. Music has also been found to influence the activity of cutaneous glands, modify electric currents of the skin, as well as alter heart rate (Long & Johnson, 1978). Long and Johnson (1978) discussed Patterson's theory that molecular vibration upon the body produces a direct physical action. The kind of vibratory wave which hits the body is determined by the quality of the original vibration. If the original sound is melodic and rhythmic, as the vibration reaches the body, it will be comfortably assimilated into the other body rhythms. In acknowledgement of this theory is the fact that music has been used since the dawn of time for relaxation, and medicine men used rhythmic chants to aid healing (Witt, 1984). If the original sound is discordant, or without rhythm, the resultant vibration hitting the body will be unpleasant and in opposition to natural body rhythms.

Long and Johnson (1978) suggested a number of characteristics or guidelines for selecting musical stimuli to aid in pain relief. These included using the following: variety of styles, adjustable volume, instrumentals, unknown melody, simple tune, major key, smooth and not syncopated, continuous, short segments, and gentle instruments. These criteria substantiate use of musical types such as soft classical and smooth jazz which research has shown act as a sedative, lowering blood pressure, slowing the pulse, and dispelling anxiety (Witt, 1984).

Certain musical selections provide an effective method of relaxation and pain reduction and may supplement or substitute for anesthetic agents. The mode of action is both physiological and psychological, inducing relaxation and/or psychological distraction. Musical stimuli vary in their effect on the body. Certain types of musical compositions are more effective in physiological and psychological pain relief than others. Long and Johnson (1978) suggested that effectiveness is also influenced by the manner of presentation, as well as compatability with patient preferences.

Summary

It has been established that the phenomenon of pain is somewhat ambiguous and mystifying. In an effort to explain the pain phenomenon, both neurophysiological and psychological theories have arisen. It would seem appropriate that the most comprehensive explanation of pain should be a meshing of both viewpoints.

A number of factors appear to influence the perception of and the reaction to pain including cultural background, attitudes and emotional factors such as anxiety. An inseparable relationship between pain and anxiety has been demonstrated in many studies. Anxiety is thought to directly influence or augment the pain experience. A number of studies support the theory that reduction of anxiety levels results in lowered intensity of perceived pain.

A variety of physiological responses are associated with the pain and anxiety experience. Although measureable, these factors do not realistically or independently project the pain experience. The subjective aspect, or point of view of the individual involved in the pain experience, is essential for a true conception of pain to be reflected. A variety of methods have been used in the subjective measurement of pain. Of these, the visual analog scale appears to have the most sensitivity. For the most accurate reflection of the pain experience, multiple measures should be used.

Pain is often a major problem encountered during therapeutic exercise with burn patients. It can hinder the progress or prolong the duration of the rehabilitative process. The type of pain associated with therapeutic exercise may be influenced by the physiological stress of the exercise itself or the emotions associated with anticipation of the exercise experience.

Methods of alleviating the stress, discomfort and pain associated with health care procedures is desirable. A variety of non-pharmacological pain control strategies exist. The primary mode of pain control by these methods is alteration of the sensory input, thereby inhibiting transmission of the pain sensation. This is most often accomplished through procedures involving counter-stimulation like distraction.

An effective form of distraction today is the use of audioanalgesia. As an analgesic agent, audioanalgesia has been effective in both dental and medical situations. It was hoped for the proposed study that audioanalgesia, using music, would lower subjective reports of pain and state anxiety in burn patients undergoing sustained stretch exercises.

CHAPTER III

METHODOLOGY

Prior to initiation of the study, the investigator was responsible for the following:

1. Preparation of the audioanalgesia cassette tapes

2. Selection or development of the following measurement instruments:

   a. "How I Feel" Scale, abbreviated form (O'Neil, 1972)

   b. Visual Analog Pain Scale (Huskisson, 1982)

   c. Peripheral body temperature recording mechanism using the Autogen 1000b Feedback Thermometer, and

3. Development of forms for recording data.

The investigator subsequently collected relevant data used in determining the relationships as expressed in the research questions.

Design

The reversal design of alternating presentation and removal of the program or treatment over time, typically associated with behavior modification programs as described by Kazdin (1975) was used for this investigation. The purpose of the design is to demonstrate a functional relationship between the target behavior and the experimental condition or program. When alteration of the experimental condition results in a systematic change in behavior, a functional relationship is demonstrated.

The design is referred to as a reversal design because phases are reversed to demonstrate the effect of the program. This design requires that the experimental condition is presented and temporarily withdrawn at some point in time. A requirement is that the contingency is altered during the reversal period to determine whether behavior is controlled by the experimental intervention. Removing the contingency is frequently the technique used for achieving a reversal.

There are variations of this basic reversal design. For purposes of this investigation, the design was alternate in nature. Upon treatment referral, patients were assigned a number in the normal sequence. All patients assigned odd numbers were subjects in Group A. All patients assigned even numbers were subjects in Group B. For Group A subjects, the initial treatment session started with a baseline session, or withholding of audioanalgesia. For Group B subjects, the initial treatment session introduced the audioanalgesia treatment. The remaining five treatment sessions alternated withholding and presentation of audioanalgesia treatment as appropriate for each subject.

Setting

A local physical medicine out-patient treatment facility was the setting for this clinical study. Within this setting, a quiet, comfortable room with standard lighting and ventilation which could be closed off from extraneous noise was selected for treatment. A bed in which the subject could lie down and pillows as appropriate were provided. The investigator sat on a rolling stool at the subject's bedside during treatment. All necessary treatment equipment such as massage lotions and towels were available in the room. All equipment and materials necessary for the investigation were also available in the room.

Sample

A convenient sample was used in the quasi-experimental research investigation, involving one group, no control with pre-treatment and post-treatment measures. The 10 subjects obtained for this study were those adult patients with burns, 18 years or older who met the following criteria:

1. Patients in the post-acute phase of burn rehabilitation.

2. Patients referred for treatment as prescribed by the physician in the selected physical medicine out-patient clinic.

3. Patients referred for prescribed treatment two times per week.

4. Patients with burns to the upper extremity with two joint involvement including the axilla, elbow, wrist or hand. (For practical purposes the joints of the hand were considered as a whole when categorizing patients).

5. Patients having no burns to the right foot.

6. Patients exhibiting no extraordinary wound or healing problems.

7. Patients with no identified or uncorrected impairments in hearing, vision, intelligence or reading ability.

8. Patients able to schedule appointments on the designated days.

Protection of Human Subjects

Appropriate consent forms were completed by all research subjects and the governing institutions prior to initiating the study. Traditional clinical patient consent forms required by the selected physical medicine clinic were used. A sample consent form is presented in Appendix A.

On all data collection forms, the subject's name appeared initially so that each designated form corresponded to the appropriate subject. To insure confidentiality, the subject was then assigned a specific number which replaced the subject's name for all further data analysis and presentation.

There were no identifiable risks to the institution where the study was undertaken. There were no extraordinary risks to subjects who were involved in the study in addition to those risks traditionally associated with post-acute rehabilitative exercise. These routine risks typically associated with sustained stretching exercise were discussed with the subjects. These included possible skin and joint discomfort and pain, skin breakdown or blistering, natural releasing of tight skin or scar bands, and potential minimal bleeding associated with stretching of minor open areas.

Instruments

Three primary instruments were used in the study. Measures of anxiety, pain, and peripheral body temperature were recorded for all subjects.

A-State Anxiety Inventory

The State-Trait Anxiety Inventory (Spielberger et al., 1970) offers two separate self-report scales for measurement of trait anxiety (A-Trait) and state anxiety (A-State). The A-State scale consists of 20 statements to which subjects are required to indicate how they feel at a particular moment in time. The A-State scale is often used to determine actual levels of A-State intensity induced by stressful situations. Scores on the A-State scale tend to increase in response to various kinds of stress (Spielberger et al., 1970).

To measure changes in A-State intensity over time, the A-State scale should be given on each occasion for which A-State measures are needed. When repeated measurements of A-States are desired, abbreviated or brief scales comprised of as few as four or five STAI A-State items may be used to provide valid measures of A-State (O'Neil, 1972).

Test retest correlations for the A-State scale are low with a median of .32 (Spielberger et al., 1970). Low values would be expected on such an inventory, however, since situational factors influence A-State anxiety and its measure is not one of a persistent characteristic of the individual. Spielberger et al. (1970) indicated that alpha coefficients, measures of internal consistency, would better indicate reliability due to the transitory nature of anxiety states. Computed by the K-R 20 formula, alpha coefficients range from .83 to .92 on the A-State scale.

A wide variety of studies demonstrate validity of the A-State scale

(Spielberger et al., 1970). In one validity study, subjects were placed in four increasingly stressful situations and anxiety scores increased corresponding with the increased amounts of stress.

For this study, an abbreviated version of the A-State scale (O'Neil, 1972) containing five items was used. Correlations of scores from the shortened version with scores from the 20 item scale have been found to be in the high .90s. In the post-treatment administrations of the scale, the wording was changed to the past tense with instructions for subjects to respond how they felt during the exercise session. Killough (1977), Wilson (1974), and Lamb and Plant (1972) have used this modification with patient populations.

Scores on the abbreviated A-State scale can range from 5 to 20. Some inventory items indicate high anxiety and others low anxiety. Scoring weights for items indicating high anxiety are the numbers as circled by the subject on the inventory form. Scoring weights for items indicating low anxiety are reversed from the number circled. For example, weighted scores of responses marked 1, 2, 3, 4 and 5 for the reversed items are 5, 4, 3, 2 and 1 respectively. Scores are then totaled. As the cumulated numerical score increasingly approaches 20, the greater the level of anxiety is indicated.

For this study, all A-State scales completed by subjects were referred to as the "How I Feel" scale. Sample A-State scales are presented in Appendix B.

Visual Analog Pain Scale

Three systems including descriptions, numbers and a visual analog scale are traditionally used for expression of pain severity (Huskisson, 1982). The visual analog is a line which is taken to represent the continuum of pain. Each end of the line is defined as the extreme of the pain experience. Subjects are generally requested to mark the scale at the point corresponding to his or her pain experience.

A vertical analog scale, 10 centimeters in length was used in this study. Descriptors were located at each endpoint. The descriptor at the lower or bottom end of the scale read "No Pain." The descriptor at the upper or top end of the scale read, "The Worst Pain I Have Ever Experienced." Each vertical analog scale was individually constructed so that discrepancy in line length would not occur.

Correlation coefficients of .70 and .64 were obtained between the vertical visual analog scale and simple descriptive and numerical rating scales of pain, respectively (Downie et al., 1978). Elton et al. (1979) indicated that the visual analog scale showed highly significant correlations ($p<.001$) with the Melzack Ordinal and Melzack Interval scales ($r=.92$) of pain measurement.

The visual analog scale is easily used by the subject and investigator. It provides the subject with a sensitive, reproducible method of expressing pain severity. This scale was used in pre-exercise and post-exercise assessment. The post-exercise assessment scale reflected the level of pain the subject experienced during the actual exercise session. To score, the investigator assigned a number from 1 to 100 corresponding to the millimeter at which the subject placed a red horizontal mark. Samples of the Visual Analog Pain Scale are presented in Appendix C. For this study, all Visual Analog Pain Scales completed by subjects were referred to as the Pain Scale.

Measurement of Peripheral Body Temperature

A biofeedback unit, the Autogen 1000b Feedback Thermometer, was used in measuring subject's peripheral body temperature. A thermal probe was placed on the interior arch of the right foot as recommended in the instruction manual. This probe was secured by paper tape and was used for assessment throughout each treatment session. Temperature readings appeared on a front panel meter display in Fahrenheit degrees continuously while the thermal probe was in place. This biofeedback instrument records peripheral body temperatures within ±.05 Fahrenheit degree accuracy. It appears to be a reliable method for recording this type of data (Autogenic Systems, Inc.).

A single pre- and post-exercise temperature was recorded. Temperatures recorded during the exercise session were averaged to obtain a single score to reflect the subject's temperature during the exercise session.

Audioanalgesia Tape

Audioanalgesia is simply defined as the suppression of pain through sound. For this study, audioanalgesia was selected stereophonic music from the classical and popular musical categories. Sony UCX-S90 high bias cassette tape was used for recording and playing selections from each musical category. All classical music was recorded on one side of one tape and all popular music was recorded on one side of a second tape. Each cassette tape contained recordings comprising at least 20 minutes in length to insure continuity of music throughout the entire treatment session.

An AIWA, model S-30 stereo cassette recorder/player with a stereophonic headphone jack was used as well as one lightweight set of AIWA stereophonic mini headphones for administration of the audioanalgesia to all subjects. A combination of the following selections for each musical category was used as suggested by Long and Johnson (1978) and Johnson (personal communication, May, 1984):

Classical

Pachelbel:	Canon in D
Dvorzak:	Slavic Dance #4 in F Major
Handel:	Air (from suite from Water Music by The Jean-Francois Paillard Chamber Orchestra)
Mahler:	Andante con moto (from symphony #2 in C Minor, Resurrection)
Drigo:	Serenade
Mozart:	Piano Concerto #21, in C Andante

Popular

Washington, Grover:	In the Name of Love (album--Winelight)
Gordon-Warren:	The More I See You (Pete Fountain)
Joplin, Scott:	The Entertainer (album--Sting)
Wall, Jeremy:	Rasul (album--Spyrogyra)
Davis, Chip:	Sonata (album--Fresh Air)
Grusin, Don:	Rainbow (album--Lee Ritenour in Rio)
Sample, Joe:	In All My Wildest Dreams (album--Rainbow Seeker)

Data Collection

Upon treatment referral, the investigator introduced herself and the purpose of the study was explained. Components of the study including duration, days of treatment, time of day for appointments, instruments to be used, procedures for selection and administration of the audioanalgesia, and procedures involved for recording the peripheral body temperature were reviewed and demonstrated. Explanations were typed out and read by the investigator to the subject so that identical explanations were given to all subjects. The consent form (Appendix A) outlining these procedures was then completed by the subjects who met the designated criteria for the study and consent was obtained to participate in the study. All demographic data was retrieved from the subject's medical chart and was recorded as indicated in Appendix D.

Each treatment session began with the subject sitting on the side of the treatment bed. A clipboard with the A-State Anxiety ("How I Feel") Inventory and the Visual Analog Pain Scale (Pain Scale) forms and a red ballpoint pen was presented to the subject. The subject was then asked to complete both forms. Written directions for both forms were read aloud to the subject by the investigator prior to the subject's completing the forms. Upon completion of the forms, the subject was requested to lie down and the thermal probe for monitoring peripheral body temperature was placed on the interior arch of the right foot. After a five minute interval, an initial temperature was recorded. A sample of this recording form is presented in Appendix E.

For sessions with audioanalgesia, the subject was then allowed to select either the classical or popular musical tape. The tape was placed in the recorder/player and the headphones were then placed on the subject and comfortably adjusted. The subject was shown the volume control and he or she was instructed to alter the volume intensity as desired. The subject's musical tape selection was documented at each treatment session in the designated space on the "How I Feel" form which reflected perceived pain during exercise. To simulate the headphone situation, but without music, headphones were also placed on the subject and comfortably adjusted during sessions without audioanalgesia.

The 20 minute treatment session then began. Peripheral body temperature readings were recorded throughout the 20 minute session. Therapist (investigator) and patient (subject) rapport was not being investigated in this study, therefore, interaction was permitted on a verbal basis during the treatment session, however, the investigator did not initiate conversation. The investigator responded to questions initiated by the subject with the exception of questions related to the subject's performance during the treatment session. The investigator indicated to the subject prior to each treatment session that these questions would be responded to after the treatment session.

All subjects were specifically instructed prior to each treatment session to verbalize pain and differentiate types of pain such as skin or joint to the investigator. It was essential for all subjects to understand the importance of expressing pain. The investigator adhered to therapeutic safety precautions in the presence of joint pain.

Immediately upon completion of the exercise session, the headphones were removed and the music was turned off, if appropriate. The subject remained lying and five minutes after the end of the session, a final peripheral body temperature was recorded.

The subject was then allowed to sit to repeat completion of the "How I Feel" and Pain Scale forms. Subjects reported their feelings in the same manner as before the exercise session, however, this time indicating how he or she felt during the exercise session.

The study occurred over a three week time period for each subject with each subject's initial session taking place on a Wednesday. Each subject kept a consistent treatment appointment time for all six sessions. Two days lapsed between treatment sessions. Audioanalgesia was administered to one-half of the subjects on Wednesday, Tuesday and Monday sessions. For the remaining subjects, audioanalgesia was administered on the Saturday, Friday and Thursday sessions. This corresponds to the reversal design.

Upon completion of all exercise sessions for the particular subject, he or she was given an opportunity to ask questions concerning the nature of the study and the subject was thanked for his or her cooperation. The subject was told that data would be available upon completion of the entire study.

The exact same setting was used for all treatment sessions. The exact procedures were utilized in all sessions except the audioanalgesia tape was not used during the designated exercise sessions without audioanalgesia.

Treatment of Data

Data obtained from this study were evaluated and interpreted in terms of the individual subject as well as for the total group of subjects. All demographic data were addressed using descriptive statistics and are presented in Chapter 4 in the narrative form.

Means and standard deviations were used with interval data obtained for the six exercise trials. All mean scores for all variables were determined by calculating the difference between the preexercise score and the score reflected during each exercise trial. All mean scores are referred to as the pre-during difference scores.

A 3-way analysis of variance with one between and two within factors, with repeated measures, was used for research questions 1, 2, and 3. Where findings were significant, Tukey's T-Method was also used to substantiate the findings. The Pearson product-moment correlation coefficients (Pearson r) was used for research questions 4-9 for establishing relationships of the variables.

Analysis was performed using the computer available at the Texas Woman's University, Dallas campus. A .05 level of significance was used. Presentation of data includes tables and figures where appropriate. Individual patient raw data are presented in Appendix F, Tables 8-13, since few significant findings were established.

CHAPTER IV

FINDINGS

The major purpose of this study was to investigate the perceived levels of pain of adult subjects with burns before and during post-acute rehabilitative exercise with and without audioanalgesia treatment. Tools of measurement were the Visual Analog Scale (Pain Scale), A-State Anxiety Inventory ("How I Feel" Scale), and recordings of peripheral body temperature. The design of the study required that each subject be exercised on six occasions with audioanalgesia treatment administration during alternate exercise trials.

This chapter reveals demographic data for all participants involved in the study. The results of the study are subsequently presented in four major sections. In the first section, the effects of audioanalgesia treatment on subjective pain reports is examined. The second section addresses the effects of audioanalgesia treatment on state anxiety measures. Peripheral body temperature and the effect of audioanalgesia treatment is examined in the third section. The interrelationships between variables for trials with and without audioanalgesia treatment are examined in the final section.

Description of Participants

The subjects in this study consisted of 10 males; 7 white and 3 black (non-Hispanic); who were undergoing prescribed post-acute burn rehabilitation exercise in the Department of Physical Medicine and Rehabilitation at The University of Texas Health Science Center at Dallas, Texas. All 10 subjects had sustained thermal burns of mixed second and third degree. Seven subjects had been injured while on duty at work and were receiving workman's compensation. The mean age of subjects was 35.3 with a range from 19-51. The mean burn percentage was 38.2 with a range from 15-57 percent. The mean number of months post burn injury was 4.5. All subjects presented with burns to the upper extremities. Four subjects had involvement of the axilla, elbow, wrist, and hand. Four subjects had involvement of the axilla and elbow. Two subjects had elbow and wrist burns, one in which the hand was also involved. All subjects presented with a combination of skin grafting and natural healing. See Appendix G for specific demographics.

Effects of Audioanalgesia on Subjective Pain

The first research question investigated in this study was: Is there a difference in pain levels reported by adult subjects with burns during post-acute exercise with and without audioanalgesia over time? Table 1 shows the means and standard deviations of perceived pain levels (pre-during difference scores) on six consecutive examinations for subjects by group as well as by audioanalgesia treatment.

Overall Visual Analog mean scores dropped for both groups over time. When examining the first and third trials without audioanalgesia treatment, the means dropped from 51.0 to 36.6 and 26.2 to 20.6 for

Group A and Group B respectively. The drop in mean scores is even more apparent when examining the first and third trials with audioanalgeisa treatment. Group A dropped from 46.6 to 21.4 and Group B dropped from 31.4 to 18.6, a 25.2 and 12.8 difference respectively. When comparing mean pain scores from the initial to final trials, without consideration of audioanalgesia treatment, Group A dropped from 51.0 to 21.4 and Group B dropped from 31.4 to 20.6, a 29.6 and 10.8 difference respectively.

Table 1

Means and Standard Deviations of Pain Scores by Group, With and Without Audioanalgesia

GROUP		TRIAL	MEAN	STANDARD DEVIATION
A				
	-AA	1	51.0	17.46
		2	55.8	21.32
		3	36.6	30.20
	+AA	1	46.6	24.81
		2	20.2	43.50
		3	21.4	37.87
B				
	-AA	1	26.2	27.82
		2	29.8	32.40
		3	20.6	21.43
	+AA	1	31.4	20.66
		2	30.4	32.53
		3	18.6	22.01

Note. AA = audioanalgesia treatment.

In Table 2, analysis of variance scores are presented for pain as a variable in relation to the first research question. The significant main effect indicated that both groups changed over time in their subjective reports of pain as measured by the Visual Analog Pain Scale. Inspection of the data shows that subjective pain scores decreased over time.

Table 2

Analysis of Variance of Subjective Pain Scores by Audioanalgesia Treatment, Group, and Time

Source	SS	df	MS	F
Group	2318.82	1	2318.82	0.63
Error	29319.53	8	3664.94	
AA	1100.82	1	1108.82	3.02
AA/Group	1450.42	1	1450.42	3.98
Error	2915.27	8	364.41	
Time	2185.83	2	1092.92	3.66*
Time/Group	435.03	2	217.52	0.73
Error	4781.47	16	298.84	
AA/Time	801.03	2	400.52	2.62
AA/Time/Group	520.63	2	260.32	1.70
Error	2443.33	16	152.71	

Note. AA = audioanalgesia treatment.
*$p < .05$

To explicate this finding, a *post hoc* analysis was conducted using Tukey's T-Method to examine differences between treatment trials. The results of these comparisons indicated that differences in pain scores when comparing trials one and three with or without audioanalgesia treatment were significant (3.75). There was no significant difference noted between other trials.

To illustrate the significant finding of pain reduction over time, total group mean scores (pre-during differences) were plotted for the three trials with and without audioanalgesia. This can be observed in Figure 1. No other interactions approached statistical significance when looking at pain as a variable.

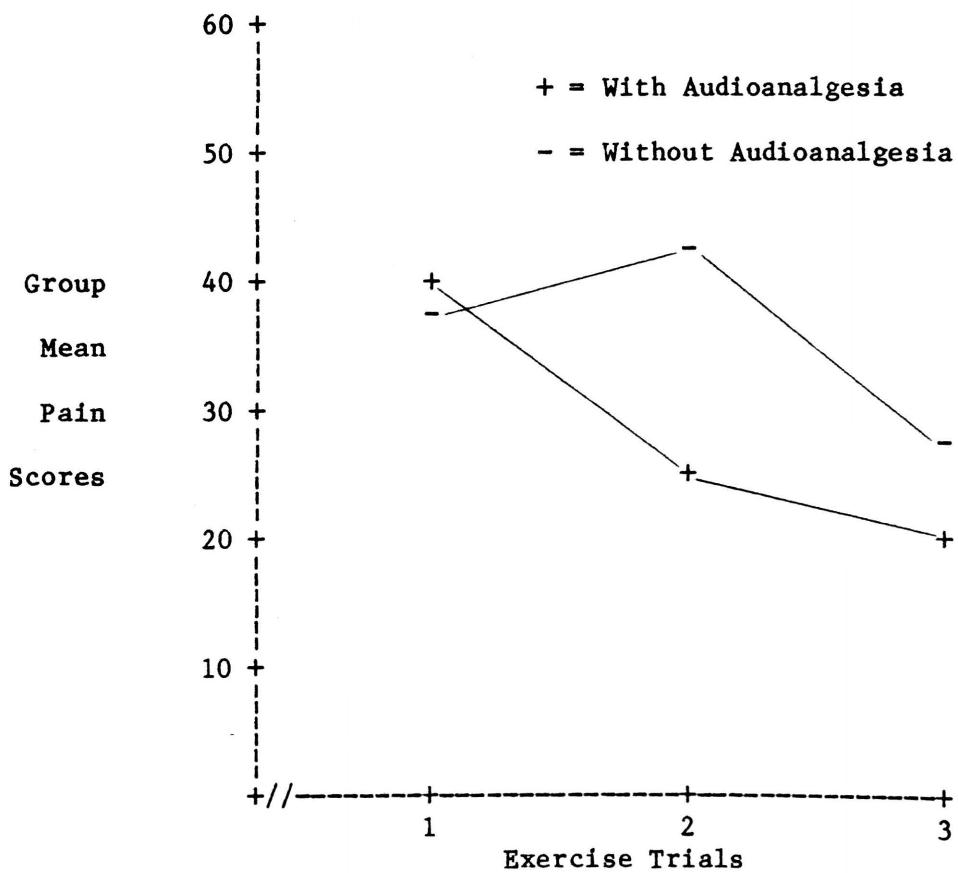

Figure 1. Subjective group response to pain over time as a function of audioanalgesia treatment.

Effects of Audioanalgesia on State Anxiety

The second research question examined if there was a difference in state anxiety levels reported by adult subjects with burns during post-acute exercise with and without audioanalgesia over time. Means and standard deviations for state anxiety scores are presented in Table 3. When comparing groups A and B during trials without audioanalgesia, Group A exhibited higher anxiety scores on all occasions. During trials where audioanalgesia was administered, anxiety scores for Group A were lower than Group B.

When comparing consecutive trials in sequence, a high-low pattern is observed in Group A. In other words, all anxiety scores during trials with audioanalgesia are lower than each preceding trial without audioanalgesia. The opposite finding was observed in Group B. A low-high pattern was evident with lower scores observed for each session without audioanalgesia treatment and higher scores observed for sessions with audioanalgesia.

In relation to the second research question, analysis of variance scores with state anxiety as a variable are presented in Table 4. A significant main effect was obtained for the response to audioanalgesia treatment by group without regard to time. To determine how each group was specifically affected, group mean anxiety scores (pre-during differences) were plotted with regard to audioanalgesia treatment. This is illustrated in Figure 2.

Table 3

Means and Standard Deviations of State Anxiety Scores by Group, With and Without Audioanalgesia

GROUP	TRIAL	MEAN	STANDARD DEVIATION
A			
-AA	1	5.2	1.30
	2	3.4	3.66
	3	3.8	4.09
+AA	1	2.6	3.58
	2	0.8	5.85
	3	2.2	3.03
B			
-AA	1	2.6	2.61
	2	2.0	2.55
	3	1.6	1.67
+AA	1	3.4	2.70
	2	3.6	2.88
	3	3.0	3.00

Note. AA = audioanalgesia treatment.

Table 4

Analysis of Variance of State Anxiety Scores by Audioanalgesia Treatment, Group, and Time

Source	SS	df	MS	F
Group	1.35	1	1.35	0.04
Error	279.80	8	34.98	
AA	3.75	1	3.75	0.81
AA/Group	46.82	1	46.82	10.05*
Error	37.27	8	4.66	
Time	11.20	2	5.60	0.81
Time/Group	7.60	2	3.80	0.55
Error	110.20	16	6.89	
AA/Time	1.60	2	0.80	0.16
AA/Time/Group	.93	2	0.47	0.09
Error	79.13	16	4.95	

Note. AA = audioanalgesia.
$*p < .02$

Further investigation using Tukey's T-Method revealed that there was no difference when comparing audioanalgesia and non-audioanalgesia treatment for Group B. Group A, on the other hand, showed a significant decrease in anxiety with audioanalgesia treatment (4.06). No other main effects or comparisons approached significance when looking at state anxiety as a variable.

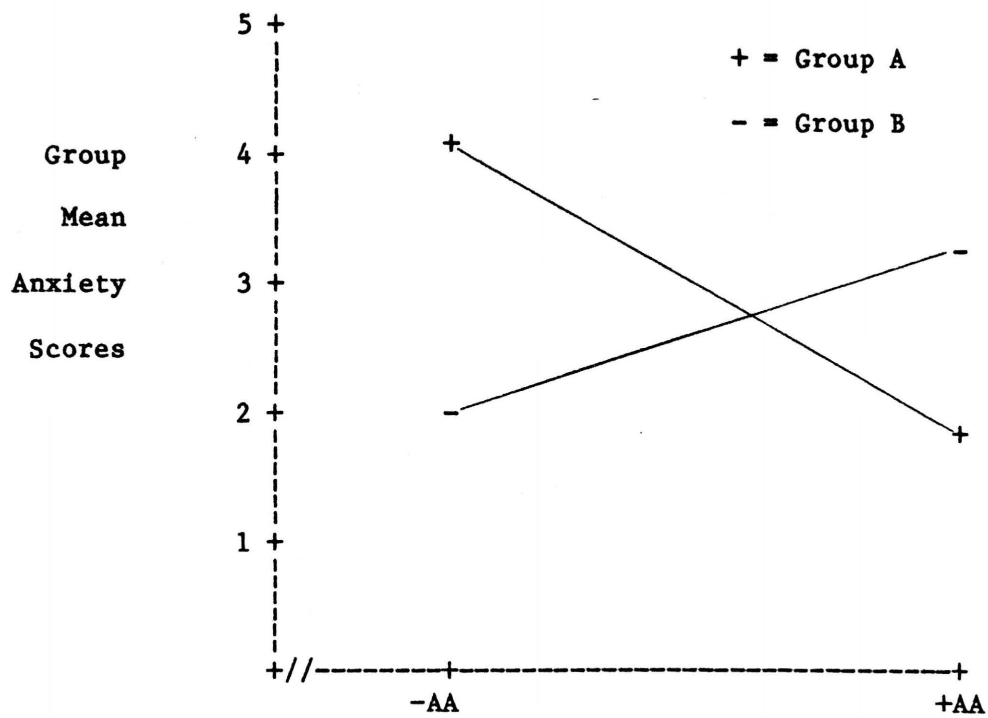

Figure 2. Group mean pain scores as a function of group and audioanalgesia treatment (AA).

The Effects of Audioanalgesia on Peripheral Body Temperature

The third research question explored the difference in peripheral body temperature measures of adult subjects with burns during post-acute exercise with and without audioanalgesia over time. Means and standard deviations of peripheral body temperatures (pre-during differences) are presented in Table 5. Group B exhibited more fluctuation in peripheral body temperature means during the six trials than Group A. When combined trial means are examined by group according to audioanalgesia treatment, Group A demonstrated lower peripheral body temperatures without audioanalgesia than Group B and higher peripheral body temperature with audioanalgesia treatment.

In response to research question number three, no significant main effects or interactions for peripheral body temperature were noted between groups, by time, or by audioanalgesia conditions as determined by analysis of variance scores with peripheral body temperature as the variable. This is observed in Table 6.

Table 5

Means and Standard Deviations of Peripheral Body Temperatures by Group, With and Without Audioanalgesia

GROUP		TRIAL	MEAN	STANDARD DEVIATION
A				
	-AA	1	-0.10	0.73
		2	0.14	0.76
		3	-0.14	0.86
	+AA	1	-0.17	0.82
		2	0.08	0.78
		3	0.01	0.32
B				
	-AA	1	1.20	1.61
		2	-1.41	3.77
		3	0.44	0.95
	+AA	1	-0.38	0.88
		2	-0.36	0.73
		3	0.11	1.11

Note. AA = audioanalgesia treatment.

Table 6

Analysis of Variance of Peripheral Body Temperature Scores by Audioanalgesia Treatment, Group, and Time

Source	SS	df	MS	F
Group	0.02	1	0.02	.01
Error	25.03	8	3.13	
AA	0.29	1	0.29	0.17
AA/Group	0.34	1	0.34	0.19
Error	14.07	8	1.76	
Time	3.46	2	1.73	1.31
Time/Group	6.96	2	3.48	2.63
Error	21.14	16	1.32	
AA/Time	4.41	2	2.20	1.05
AA/Time/Group	4.38	2	2.19	1.04
Error	33.58	16	2.10	

Note. AA = audioanalgesia.

The Relationships of Variables

Pearson product-moment correlation coefficients were computed to determine the following relationships during post-acute exercise with regard to audioanalgesia (AA) treatment:

1. Pain/State Anxiety with AA,
2. Pain/State Anxiety without AA,
3. Pain/Peripheral Body Temperature (PBT) with AA,
4. Pain/PBT without AA,
5. State Anxiety/PBT with AA, and
6. State Anxiety/PBT without AA.

The correlation matrix is presented in Table 7.

Table 7

Correlation Coefficients Between All Variables

Variable	Anxiety (AA)	Pain (AA)	PBT	Anxiety	Pain
PBT (AA)	-0.24	-0.21	-2.12	-0.26	1.35
Anxiety (AA)		0.63**	-0.12	0.43*	0.23
Pain (AA)			3.59	0.51**	0.66**
PBT				-4.63	4.50
Anxiety					0.62

Note. AA = audioanalgesia. PBT = peripheral body temperature.
*$p < .05$
**$p < .01$

These correlations suggest that there is a significant positive correlation between pain and anxiety in the presence and absence of audioanalgesia treatment. Other significant positive correlations were noted between pain/pain(AA), pain(AA)/anxiety, and anxiety/anxiety(AA).

Summary

Two significant main effects were noted in this study investigating the effects of audioanalgesia using subjective pain, state anxiety and peripheral body temperature measures as indicators of pain during exercise for 10 adult male subjects with thermal burns. The first main effect indicated that both groups demonstrated reduced pain levels over time, particularly noted between the first and third exercise trials regardless of audioanalgesia treatment. The second significant main effect indicated that Group A and Group B responded differently in regard to audioanalgesia treatment. Group A demonstrated a significant decrease in anxiety with audioanalgesia treatment.

A significant positive relationship between pain and anxiety both with and without audioanalgesia treatment was found. Pain during audioanalgesia treatment also demonstrated a significant positive relationship with pain and anxiety without audioanalgesia treatment. Anxiety with and without audioanalgesia treatment demonstrated a significant positive relationship as well.

CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Within the setting of a rehabilitation center, it is relevant to evaluate physiological and psychological factors influencing the pain experience which accompanies many necessary treatment procedures. It is the obligation of the clinician or researcher to engage in studies that significantly improve our understanding of pain and analgesic mechanisms, therefore improving our ability to treat pain (Melzack, 1983). Future studies would assist in searching for new methods of pain control.

Summary

The relationship of pain to progress in physical rehabilitation and the interaction of these two variables with certain affective, cognitive, and physiological states requires examination in the pain assessment of disabled patients such as the severely burned. Some of the ways in which pain interferes with rehabilitation have been outlined by Rusk (1958). Pain, he indicated could:

1. Prevent physical activities necessary for progress.
2. Lead to somatic preoccupation and withdrawal from rehabilitation program participation.
3. Bring sources of secondary gain.
4. Lead to interpersonal problems with staff and peers.

To examine the problem of pain and methods of pain control in the clinical situation more closely, this study explored the effects of audioanalgesia treatment on levels of pain, state anxiety, and peripheral body temperature during post-acute rehabilitative exercise with adult subjects with burns. In this effort to evaluate the effects of audioanalgesia as a method of pain control, 10 adult male subjects who had sustained moderate to severe thermal burns to the upper extremity were studied. All subjects were in the post-acute phase of burn rehabilitation undergoing the necessary treatment in an effort to achieve optimal functional recovery.

Pertinent measures were recorded at each of six exercise sessions over a three week period. Audioanalgesia treatment was administered to subjects in an alternating fashion, which is consistent with the reversal design of program evaluation. Group A subjects received audioanalgesia on the even numbered sessions while Group B subjects received audioanalgesia during odd numbered sessions.

Pain assessment or measurement tools included the Visual Analog Pain Scale, A-State Anxiety Inventory, and peripheral body temperature recordings for the respective questions investigated:

1. Is there a difference in pain levels reported by adult subjects with burns during post-acute exercise with and without audioanalgesia over time?

2. Is there a difference in state anxiety levels reported by adult subjects with burns during post-acute exercise with and without

audioanalgesia over time?

3. Is there a difference in peripheral body temperatures of adult subjects with burns during post-acute exercise with and without audioanalgesia over time?

4. Are there relationships among the variables of pain, anxiety, and peripheral body temperatures in regard to audioanalgesia treatment?

Conclusions

In this study, the variables of pain, state anxiety, and peripheral temperature were examined independently in regard to group, audioanalgesia treatment, and time. Variables were also examined by interactions of group, treatment and time. Based on examination in this manner, the data of this study supported the following conclusions:

1. All subjects experience pain and anxiety during post-acute burn rehabilitative exercise.

2. Pain and anxiety are significantly related regardless of situational factors.

3. Audioanalgesia treatment may reduce perceived levels of pain as indicated by subjects during post-acute burn rehabilitative exercise, therefore, pain can be affected by appropriate procedures.

4. State anxiety during post-acute rehabilitative exercise with adult subjects with burns is influenced by audioanalgesia treatment.

5. Peripheral body temperature is not a useful tool in evaluating perceived pain for adult subjects with burns during post-acute rehabilitative exercise.

6. Subjective pain measures are more appropriate than physiological measures in the assessment of clinical pain.

7. Research and educational programs should continue in an effort to establish more effective methods of pain control in the clinical situation.

Discussion

During the course of post-acute rehabilitative exercise with adult subjects with burns, all subjects reported varying levels of pain using the Visual Analog Pain Scale and A-State Anxiety Inventory as measures. According to Spielberger (1966, 1972), A-State anxiety levels should be high in circumstances that are perceived as threatening, and relatively low in situations in which there is little or no danger. The results of this study are consistent with the Spielberger conception, indicating that physical injury in the form of a severe burn and subsequent rehabilitative therapy is stressful for the majority of patients.

It was found in this study that perceived pain levels declined significantly over the six exercise trials regardless of audioanalgesia treatment. This might be attributed to the fact that as healing occurs, physical improvement occurs with less tissue threat, thereby lessening the perception of pain. Wilson (1974) found a similar reduction of reported pain and state anxiety over time during hydrotherapy debridement with burn patients. Another possible explanation for this finding might be that patients accommodate to rehabilitative exercise over time. Just as burn scar contractures accommodate or yield to passive stretch through an appropriate exercise regimen (Lowenthal et al., 1979), patients also become more familiar with, or accommodate to, their rehabilitation program and demonstrate less apprehension. Anticipation of exercise is variable as Edington and Edgerton (1976) indicated. Individuals who often become scared, worried, or overexcited about exercise would be the typical burn patient in the early stages of post-acute rehabilitation. For most patients, concern over exercise lessens as expectations are understood and improvement is observed.

As a result of interaction with, and observation of fellow patients going through similar rehabilitative exercise programs, role expectations may be clarified. Behaviors may also be learned or modeled after other patients. As Weisenberg (1975) indicated, people learn to express their pain reactions by observing the reactions of others, choosing models similar to themself. Patients undergoing burn rehabilitation may therefore demonstrate decreased pain as a result of stoical attitudes exhibited by their peers.

As Kessler and Hertling suggested (1983), past experience is likely to have an influence on perceived pain. For patients in this study, remembering procedures in the early stages of burn care brings a strong association with pain. In comparison to the pain of hydrotherapy debridement, exercise has been claimed by most patients to be a much more tolerable experience. As patients become more involved with their current program of rehabilitation, their attention lessens to past experience. Decreases in pain could be observed based simply on the fact that the length of time increases from the time of the most painful aspects of burn care, thus a decreased associative pain reaction.

Another point of interest in this study was the fact that groups responded significantly different to audioanalgesia treatment as indicated by state anxiety measures. The order of audioanalgesia administration may have influenced responses of the two groups. At the initial session, Group A received no audioanalgesia treatment and Group B received audioanalgesia treatment. Mean anxiety scores for the groups respectively were 5.2 and 3.4. Perhaps the initial effect of the audioanalgesia treatment at the first treatment session for Group B kept anxiety low throughout all remaining treatment sessions. Although the mean anxiety score (all like sessions combined) increased from 2.07 without treatment to 3.33 with audioanalgesia treatment for Group B, this was non-significant. The mean anxiety score (all like sessions combined) decreased from 4.1 without treatment to 1.86 with audioanalgesia treatment for Group A, a significant comparison.

There are several possible explanations for this finding. Repeated exposure to audioanalgesia seemed to lead to greater anxiety reduction in Group A. Marone (1968) found that repeated exposure to audioanalgesia lead to greater suppression of pain. Due to the established relationship between pain and anxiety, this would be expected. Increased familiarity with exercise treatments could also account for the decline in state anxiety for Group A. In a similar study of burn patients by Wilson (1974), state anxiety decreased from the initial to final test administration, attributed to increased healing of burn wounds and familiarity with the procedure of hydrotherapy debridement.

The opposite response to audioanalgesia by Group B might be attributed to patient music preference. During this study, a number of subjects in Group B expressed a preference for different styles of music than the musical tapes offered. The possible influence of culture is perhaps evidenced as subjects requested country-western and "soul" music over the popular and classical selections offered. Increased anxiety could have resulted in Group B during sessions with audioanalgesia due to anxiousness from dislike of the specific music.

The fact that no significant findings were observed in this study in regard to the peripheral body temperature variable is not totally surprising. The fact that there is possible variance in skin temperatures among ethnoracial groups as suggested by Weisenberg (1975) might partially account for the great variability of temperatures recorded during this study.

Although there was not a significant relationship, Group A demonstrated higher mean temperatures during audioanalgesia treatment and lower mean temperatures during non-audioanalgesia treatment in comparison to Group B when examining combined trials. This would tend to support the premise that when the body is less stressed, or approaching a state of homeostasis, peripheral circulation increases as observed by vasodilation (Wolpe, 1958) and peripheral temperature increases. When the body perceives pain, on the other hand, the sympathetic nervous system is aroused producing physiological changes including decreased peripheral circulation as exhibited by vasoconstriction and reduced temperatures. Abram et al. (1980) noted similar findings. Vasoconstriction resulted as pain was experienced during transcutaneous electrical stimulation and vasodilation occurred secondary to pain relief as evidenced by increased skin temperature. This finding, although non-significant, lends supportive information for continued investigation into the use of audioanalgesia as a method of pain control.

The exercise experience appeared to have little if any influence on peripheral temperature in this study. This was expected based on the theories of exercise intensity. Mild exercise has no influence on small vessels while exhausting exercise causes severe vasoconstriction (Lowenthal et al., 1979). Passive in nature, exercise related to this study should therefore have no influence on blood flow and peripheral temperature. The fact that no significant changes in peripheral body temperature were noted in relation to exercise might also be supported by the fact that blood flow is generally influenced by the muscular activity of the specific limb involved in the exercise experience. In this study, the upper extremity was the limb being exercised and the arch of the right foot was the site for peripheral temperature recordings. It would therefore seem reasonable that changes in peripheral temperature should be associated more closely with the emotional aspect of attitude toward, or anticipation of exercise rather than the physical nature of the exercise.

Significant positive correlations were noted in this study between pain and anxiety. Of all possible relationships between pain with and without audioanalgesia, and anxiety with and without audioanalgesia, only one relationship was non-significant: the anxiety with audioanalgesia and pain without audioanalgesia relationship. These relationships lend overwhelming support to the premise that regardless of the treatment situation, the concepts of pain and anxiety demonstrate a continual interaction and effect on one another. This relationship between pain and anxiety has been established by a number of others (Fordyce, 1976; Killough, 1977; Sternbach, 1968; Weisenberg, 1975). These relationships also suggest possibilities that perceived levels of pain may be sufficiently influenced by audioanalgesia treatment.

Lack of more significant findings in this study may be attributed to the small sample size. Motivation of patients may also have had an influence on perceived pain levels. For some patients in this study, there was a possible lack of motivation to get better. Getting better could mean return to work and it is probable some patients would fear returning to a job where they had been severely injured. For others, return to work would mean losing workman's compensation. Getting better might also mean a sudden reduction of attention which had been brought about by the burn injury. All of these factors could influence the psychological perceptions of pain. Individual differences as indicated by Weisenberg (1975) could account for varying responses in pain perception as well.

Recommendations

To verify the findings of this study and to determine additional effects, audioanalgesia as a method of pain control should continue to be investigated in the clinical setting with the following recommendations:

1. Use a larger study population.

2. Expand the study to include female subjects.

3. Investigate the effects of audioanalgesia with age as a variable.

4. Provide greater variety of musical selections for audioanalgesia.

5. Continue the reversal design of program evaluation to further verify the influence of order of audioanalgesia presentation.

6. Investigate the effects of audioanalgesia with motivational aspects of recovery as a variable.

In an effort to find solutions to the complex problem of pain, an interdisciplinary approach must be taken. It is important for students in the future to learn appropriate communication as they reveal the mechanisms of pain and discover new, more effective forms of therapy (Melzack, 1983). An understanding of the basic tools of measurement and assessment is essential for communication among individuals who are concerned with methods of pain control.

The trend for the future should focus upon educational models in prevention or control of pain. New methods of pain control can be taught just as biofeedback is used in controlling migraine headaches, hypertension, and anxiety. It is both the responsibility of the patient and clinician to promote self-regulation through education. As Stein (1980) stated, "The trend toward self-regulation in health will eventually lead to adult responsibility for one's own well-being" (p.41).

APPENDICES

APPENDIX A

PATIENT CONSENT FORM

THE EFFECTS OF AUDIOANALGESIA ON PAIN, STATE ANXIETY AND PERIPHERAL TEMPERATURE OF ADULT BURN PATIENTS DURING POST-ACUTE REHABILITATIVE EXERCISE

Southwestern Medical School

INVESTIGATORS: Donna Nothdurft, OTR and Phala A. Helm, M.D.

You are invited to participate in a research study of pain suppression during post-acute rehabilitative exercise. Pain is often a factor which makes it difficult to engage in the necessary stretching exercises required to maintain range of motion and skin pliability in the later stages of burn recovery. You were selected as a possible participant in this study because you have received a burn injury and you are now coming in for rehabilitation therapy so that you can achieve optimal functional recovery.

If you decide to participate, you will be asked to attend six of your regular therapy sessions, as prescribed by your doctor, with two days between sessions. Therapy sessions will last for 20 minutes in which you and the therapist will perform the necessary stretching exercises to your healing burns. You will be asked to begin this study on a Wednesday. You and the therapist will establish the best treatment time for both of you and this will remain the same for all six treatment sessions.

At each treatment session, you will be asked to complete two forms related to how you feel. You will complete each of these forms before the exercise sessions begins. You will complete these same forms after the exercise session is over. The therapist will review these forms with you and there are written directions on the forms as well. There are no right or wrong answers.

At each treatment session, your body temperature will be recorded using a machine called the Autogen 1000b Feedback Thermometer. A thermal probe will be placed on the interior arch of your right foot, secured with paper tape. This should not be painful. Your temperature will be registered on a gauge and the therapist will record your temperature before, during, and after your exercise session.

On alternate treatment sessions, you will be allowed to select a musical tape from the classical or popular musical categories. You will listen to the tape you select using a small cassette recorder/player with headphones. You will be allowed to control the volume of the music to your comfort and liking. The therapist will decide which treatment sessions in which you will listen to music.

There are no extraordinary risks associated with your participation in this study other than those routinely associated with your prescribed therapy. You might experience some discomfort and pain in the skin and joints during your stretching exercises. Your skin could possibly develop small blisters or tender areas as a result of the massaging and stretching. Minimal bleeding may occur in tissue surrounding small open areas when the tissues are stretched. Releasing of tight skin may occur naturally when tight skin or scar bands are stretched.

We will make every effort at preventing physical injury that could result from this research. Compensation for physical injury incurred as a result of participating in this research is not available. The investigators are prepared to advise you about medical treatment in case of adverse effects of these procedures. You should report any problems to Miss Donna Nothdurft at work at 688-2288.

We cannot and do not guarantee or promise that you will receive any benefits from this study. You have a right to privacy, and all information that is obtained in connection with this study and that can be identified with you will remain confidential. No information gained from this study that can be identified with you will be released to anyone other than the investigators and their associates. The results of this study may be published in scientific journals without identifying you by name.

If at any time you have questions about this research or about your rights as a subject, we expect you to ask us and we shall be happy to answer. If you have questions later, or if you wish to report any adverse effects related to this research, please contact Miss Donna Nothdurft at 688-2288.

Participation in this research study is entirely voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without affecting your status as a patient or the medical care you will receive. If you wish, you may have a copy of this document to keep.

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE IN THIS STUDY. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE, HAVING READ (OR BEEN READ) THE INFORMATION PROVIDED ABOVE.

Signature of Subject	Date Time
Relationship to Subject	Signature of Witness
	Signature of Investigator

APPENDIX B

"HOW I FEEL" SCALE

"How I Feel" Scale

(Pre-Exercise)

Name: ______________________ Date: ___________

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel right now, that is, at this moment.

There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately so	Very Much so
1. I am relaxed . . .	1	2	3	4
2. I am tense . . .	1	2	3	4
3. I am jittery . . .	1	2	3	4
4. I feel calm . . .	1	2	3	4
5. I feel at ease . .	1	2	3	4

"How I Feel" Scale

(During Exercise)

Name: ______________________ Date: __________

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you felt <u>during treatment</u>. There are no right or wrong answers.

	Not at all	Somewhat	Moderately so	Very Much so
1. I was relaxed . .	1	2	3	4
2. I was tense . . .	1	2	3	4
3. I was jittery . .	1	2	3	4
4. I felt calm . . .	1	2	3	4
5. I felt at ease . .	1	2	3	4

APPENDIX C

PAIN SCALE

Pain Scale (Pre-Exercise)

Name: ______________________ Date: _____________

DIRECTIONS: Think of the worst pain that you have ever experienced or can imagine experiencing. This level of pain will correspond to the uppermost or highest point on the vertical line you see below, where it says, "The Worst Pain I Have Ever Experienced." Now think of a pain-free state or imagine no pain. This level of no pain will correspond to the lowest point on the vertical line you see below, where it says, "No Pain." Place a red horizontal line at that point on the vertical line, intersecting it, which corresponds to the amount of pain you are feeling at this moment. There is no right or wrong answer.

THE WORST PAIN
I HAVE EVER EXPERIENCED
(high)

(low)
NO PAIN

Pain Scale (During Exercise)

Name: ______________________ **Date:** ____________

DIRECTIONS: Think of the worst pain that you have ever experienced or can imagine experiencing. This level of pain will correspond to the uppermost or highest point on the vertical line you see below, where it says, "The Worst Pain I Have Ever Experienced." Now think of a pain-free state or imagine no pain. This level of no pain will correspond to the lowest point on the vertical line you see below, where it says, "No Pain." Place a red horizontal line at the point on the vertical line, intersecting it, which corresponds to the highest amount of pain you felt <u>during</u> the exercise session. There is no right or wrong answer.

THE WORST PAIN
I HAVE EVER EXPERIENCED
(high)

(low)
NO PAIN

APPENDIX D

DEMOGRAPHIC INFORMATION FORM

DEMOGRAPHICS

NAME: ______________________________

NUMBER: ______________________________

AGE: ______________________________

SEX: ________Male

________Female

DATE OF INJURY: ____________________

BURN ETIOLOGY &
DESCRIPTION: ________Thermal
________Chemical
________Electrical

PERCENTAGE BURN: ________Second
________Third

BURN LOCATION: ________Axilla
________Elbow
________Wrist
________Hand

TYPE HEALING: ________Spontaneous (Non-grafted)
________Grafted (indicate locations)

____

ETHNIC BACKGROUND: ________White(Non-Hispanic)
________Black(Non-Hispanic)
________Hispanic
________Asian or Pacific Islander
________American Indian or Alaskan Native
________Other

APPENDIX E

PERIPHERAL BODY TEMPERATURE RECORDING FORM

Peripheral Body Temperature
Recording Form

Name: ______________________________

Treatment Session	Date	Temperature °F Before Exercise	Avg. Temp. °F During Exercise	Temperature °F After Exercise
1				
2				
3				
4				
5				
6				

APPENDIX F

INDIVIDUAL PATIENT DATA

Table 8

Group A Individual's Subjective Pain Scores For All Exercise Trials

Subject	Subjective Pain Scores/Exercise Trial					
	1(-AA)	2(+AA)	3(-AA)	4(+AA)	5(-AA)	6(+AA)
1	54	55	53	-3	15	6
3	27	20	25	-38	6	-8
5	40	59	49	43	49	38
7	68	77	76	76	82	80
9	66	22	76	23	31	-9

Note. +AA = with audioanalgesia. -AA = without audioanalgesia.

Table 9

Group B Individual's Subjective Pain Scores For All Exercise Trials

Subject	Subjective Pain Scores/Exercise Trial					
	1(+AA)	2(-AA)	3(+AA)	4(-AA)	5(+AA)	6(-AA)
2	55	12	4	9	-4	14
4	36	22	30	21	32	21
6	10	7	12	1	1	8
8	46	75	86	83	49	57
10	10	15	20	35	15	3

Note. +AA = with audioanalgesia. -AA = without audioanalgesia.

Table 10

Group A Individual's State Anxiety Scores For All Exercise Trials

Subject	State Anxiety/Exercise Trial					
	1(-AA)	2(+AA)	3(-AA)	4(+AA)	5(-AA)	6(+AA)
1	4	6	7	5	5	4
3	6	0	1	-7	0	0
5	4	6	2	5	8	4
7	7	3	7	5	7	5
9	5	-2	0	-4	-1	-2

Note. +AA = with audioanalgesia. -AA = without audioanalgesia.

Table 11

Group B Individual's State Anxiety Scores For All Exercise Trials

Subject	State Anxiety/Exercise Trial					
	1(+AA)	2(-AA)	3(+AA)	4(-AA)	5(+AA)	6(-AA)
2	5	2	1	-1	3	4
4	1	2	6	2	6	2
6	6	0	0	0	0	0
8	5	7	6	4	6	2
10	0	2	5	5	0	0

Note. +AA = with audioanalgesia. -AA = without audioanalgesia.

Table 12

Group A Individual's Peripheral Body Temperatures For All Exercise Trials

Subject	Peripheral Body Temperature/Exercise Trial					
	1(-AA)	2(+AA)	3(-AA)	4(+AA)	5(-AA)	6(+AA)
1	-.08	-.29	-.29	-.33	-1.17	-.47
3	-.78	-1.18	1.18	1.40	-.20	.37
5	-.36	-.08	-.24	-.60	-.62	.03
7	1.13	1.09	-.64	-.17	1.10	-.08
9	-.42	-.39	.68	.11	.20	.24

Note. +AA = with audioanalgesia. -AA = without audioanalgesia.

Table 13

Group B Individual's Peripheral Body Temperatures For All Exercise Trials

Subject	Peripheral Body Temperature/Exercise Trial					
	1(+AA)	2(-AA)	3(+AA)	4(-AA)	5(+AA)	6(-AA)
2	-1.03	3.70	.47	.19	-.70	1.73
4	-1.40	.36	.23	-8.12	-.25	.44
6	.83	1.74	-.77	.81	1.86	.31
8	-.32	.71	-.40	2.00	.48	.68
10	.01	-.50	-1.31	-.13	-.86	-.94

Note. +AA = with audioanalgesia. -AA = without audioanalgesia.

APPENDIX G

PATIENT DEMOGRAPHICS

Table 14

Individual Subject Demographic Data

Subject	Age	Ethnic Background	Burn %	Months Post Burn
Group A				
1*	39	Black	55	7
3*	19	Black	23	3.5
5	48	White	15	5
7*	51	White	31	4
9*	38	White	26	4
Group B				
2	33	Black	26	5
4*	32	White	43	4
6*	23	White	57	4
8*	34	White	23	4
10	36	White	52	4

Note. * = Workman's compensation.
All subjects were male and all had sustained thermal burns.

REFERENCES

Abram, S. E., Asiddao, C. B., & Reynolds, A. C. (1980). Increased skin temperature during transcutaneous electrical stimulation. _Anesthesia and Analgesia_, _59_, 22-25.

Auerbach, S. M. (1973). Trait-state anxiety and adjustment to surgery. _Journal of Consulting and Clinical Psychology_, _40_, 264-271.

Autogenic Systems, Inc. _Instruction manual for the autogen 1000b_. Berkeley, CA: Author.

Cattell, R. B., & Scheier, I. H. (1958). The nature of anxiety: A review of thirteen multivariate analyses comprising 814 variables. _Psychological Reports_, _4_, 351-388.

Dick-Read, G. (1959). _Childbirth without fear_. New York: Harper & Row.

Downie, W. W., Leatham, P. A., Rhind, V. M., Wright, V., Branco, J. A., & Anderson, J. A. (1978). Studies with pain rating scales. _Annals of the Rheumatic Diseases_, _37_, 378-381.

Edington, D. W., & Edgerton, V. R. (1976). _The biology of physical activity_. Boston: Houghton Mifflin Company.

Elton, D., Burrows, G., & Stanley G. (1979). Clinical measurement of pain. _Medical Journal of Australia_, _1_, 109-111.

Fordyce, W. E. (1976). _Behavioral methods for chronic pain and illness_. Saint Louis: The C. V. Mosby Company.

Freud, S. (1936). _The problem of anxiety_. (Translated by Henry Bunker). New York: The Psychoanalytic Quarterly Press.

Gardner, W. J., Licklider, J., & Weisz, A. Z. (1960). Suppression of pain by sound. _Science_, _132_, 32-33.

Gatchel, R. J., & Baum, A. (1983). _An introduction to health psychology_. Massachusetts: Addison-Wesley Publishing Company.

Grzesiak, R. C. (1975, November). Simple relaxation techniques in treatment of chronic pain: Case reports. Paper presented at the 52nd Annual Session of the American Congress of Rehabilitation Medicine, Atlanta, GA.

Gulledge, S. L., & Kline, O. R. Jr., M.D. (1981). Use of headphones for patient relaxation during cataract surgery under local anesthesia. Opthalmic Surgery, 12(4), 289-290.

Guyton, A. C. (1971). Textbook of medical physiology. Philadelphia: W. B. Saunders Company.

Hodges, W. (1968). Effects of ego threat and threat of pain on state anxiety. Journal of Personality and Social Psychology, 8, 364-372.

Houde, R. W. (1982). Methods for measuring clinical pain in humans. Acta Anaesthesia Scandanavian, 74, 25-29.

Huskisson, E. C. (1982). Measurement of pain. Journal of Rheumatology, 9(5), 768-769.

Ignelzi, R. J., M.D., & Atkinson, J. H., M.D. (1980). Pain and its modulation. Neurosurgery, 6(5), 577-581.

Kazdin, A. E. (1975). Behavior modification in applied settings. Homewood, IL: The Dorsey Press.

Kenner, C., & Achterberg, J. (1983, March). Non-pharmacologic pain relief for burn patients. Paper presented at the Annual Convention of the American Burn Association, New Orleans, LA.

Kessler, R. M., & Hertling, D. (1983). Management of common musculoskeletal disorders. Philadelphia: Harper & Row.

Killough, F. A. (1977). Pain and anxiety of burn patients during the course of hydrotherapy debridement. Unpublished thesis, The University of Texas Health Science Center at Dallas.

Lamb, D. H., & Plant, R. (1972). Patient anxiety in the dentist's office. Journal of Dental Research, 51, 986-989.

Lavine, R., Bushbaum, M. S., & Poncy, M. (1976). Auditory analgesia: somatosensory evoked response and subjective pain rating. Psychophysiology, 13(2), 140-148.

Locsin, R. (1981). The effect of music on the pain of selected post-operative patients. Journal of Advanced Nursing, 6, 19-25.

Long, L., & Johnson, J. (1978). Using music to aid relaxation and relieve pain. Dental Survey, 8, 35-38.

Lowenthal, D. T., Bharadwaja, K., & Oaks, W. W. (1979). Therapeutics through exercise. New York: Grune & Stratton.

McAdoo, G. W. (1971). The effects of success, mild failure, and strong failure feedback on A-state for subjects who differ in A-trait. Dissertation Abstracts International, 31(A), 2112.

Marone, J. G. (1968). Suppression of pain by sound. Psychological Reports, 22, 1055-1056.

Melzack, R., & Wall, P. D. (1970). Psychophysiology of pain. International Anesthesiology Clinics, 8, 3-34.

Melzack, R. (1973). The puzzle of pain. New York: Basic Books, Inc.

Melzack, R. (1983). Pain measurement and assessment. New York: Raven Press.

Morosko, T. E. (1972). The effect of audioanalgesia on pain threshold and pain tolerance. Dissertation Abstracts, 1626.

Newmark, C. S. (1972). Stability of state and trait anxiety. Psychological Reports, 30, 196-198.

Ohnhaus, E. E., & Adler, R. (1975). Methodological problems in the measurement of pain: A comparison between the verbal rating scale and the visual analogue scale. Pain, 1, 379.

O'Neil, H. F., Jr. (1972). Effects of stress on state anxiety and performance in computer assisted learning. Journal of Educational Psychology, 63, 473-481.

Rich, P. R. (1980). Relieve their anxieties with audioanalgesia. Dental Practice, 2, 54-57.

Rogers, C. R. (1951). _Client-centered th erapy_. Cambridge: The Riverside Press.

Rusk, H. A. (1958). _Rehabilitation Medicine_ (pp.9-16). Saint Louis: C. V. Mosby Company.

Schacham, S., & Daut, R. (1981). Anxiety or pain: what does the scale measure? _Journal of Consulting and Clinical Psychology_, _49_(3), 468-469.

Scott, J., & Huskisson, E. C. (1979). Vertical or horizontal visual analogue scales. _Annals of Rheumatic Diseases_, _38_, 560.

Selye, H. (1950). _The physiology and pathology of exposure to stress_. Montreal: Medical Publishers.

Spielberger, C. D. (Ed.). (1966). Theory and research on anxiety. _In anxiety and behavior_. New York: Academic Press.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). _Manual for the state-trait anxiety inventory_. Palo Alto, CA.: Consulting Psychologist Press.

Spielberger, C. D. (Ed.). (1972). _Anxiety: Current trends in theory and research_ (Vol. 1). New York: Academic Press.

Spielberger, C. D. (1975). Anxiety: State-trait process. In C. D. Speilberger and I. G. Sarason (Eds.), _Stress and anxiety_ (Vol. 1). Washington D. C.: Hemisphere/Wiley.

Sriwatanakul, K., Kelvie, W., & Lasagna, L. (1982). The quantification of pain: An analysis of words used to describe pain and analgesia in clinical trials. _Clinical Pharmacology Therapeutics_, _32_(2) 143-148.

Stein, F. (1980). _Anatomy of research in allied health_. Cambridge: Schenkman Publishing Company, Inc.

Sternbach, R. A. (1968). _Pain: A psychophysiological analysis_. New York: Academic Press.

Sternbach, R. A. (1974). _Pain patients: Traits and treatment_. New York: Academic Press.

Sternbach, R. A. (1976). Psychological factors in pain. In J. J. Bonica and D. Albe-Fessard (Eds.), Advances in pain research. New York: Raven Press.

Szasz, T. S. (1957). Pain and pleasure: A study of bodily feelings. New York: Basic Books.

Vista, I. D., & Faurot, A. (1978). Culture currents of world music. Quezon City: New Day Publishers.

Weisenberg, M. (1975). Pain and experimental perspectives. Saint Louis: The C. V. Mosby Company.

Weisenberg, M., Kreindler, M. L., Schachat, R., & Werboff, J. (1975). Anxiety and attitudes in black, white, and Puerto Rican patients. Psychosomatic Medicine, 37, 123-135.

Wilson, W. (1974). The effect of hydrotherapy debridement of state anxiety as a function of trait anxiety and percent of body burn. Unpublished thesis, The University of Texas Health Science Center at Dallas, Texas.

Witt, J. (1983, July 16). Music soothes and helps terminal cancer patients cope. Fort Wayne News Sentinel, p.3D.

Wolfe, D. E. (1978). Pain rehabilitation and music therapy. Journal of Music Therapy, 15(4), 162-178.

Wolpe, J. (1958). Psychotherapy by reciprocal inhibition. Stanford: Stanford University Press.

Wolpe, J. (1973). The practice of behavior therapy. New York: Pergamon Press.

Zborowski, M. (1969). People in pain. San Francisco: Jossey-Bass.