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Audio Biofeedback And Level Of Stress In The Minimally Prepared Gravida During Labor.

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AUDIO BIOFEEDBACK AND LEVEL OF STRESS IN THE MINIMALLY PREPARED GRAVIDA DURING LABOR

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AUDIO BIOFEEDBACK AND LEVEL OF STRESS IN THE MINIMALLY PREPARED GRAVIDA DURING LABOR

by

SYLVIA SQUIRES BRITT

A DISSERTATION

Submitted in partial fulfillment of the requirements for the degree of Doctor of Science in the Department of Nursing in the Graduate School, University of Alabama in Birmingham

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ABSTRACT OF DISSERTATION

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Title Audio Biofeedback and Level of Stress in the Minimally Prepared Gravida During Labor

The purpose of the research was to assess selected physiologic parameters of the minimally prepared laboring gravida in response to the nursing intervention of continuous audio biofeedback. Selye's framework of stress/adaptation provided theoretical guidance for the study.

A survey of the literature revealed a paucity of information relating to minimally prepared gravidas during labor. There were no studies reporting empirically tested nursing interventions for women who had not attended childbirth preparation classes.

An experimental design was followed with a total sample size of 40 women. Criterion measures included physiologic parameters of systolic (SBP) and diastolic blood pressure (DBP), pulse rate (P), respiratory rate (R), and electromyograph score (EMG).

Twenty control subjects were monitored for criterion measures every 15 minutes throughout labor. The 20 experimental clients were introduced to audio biofeedback during a ten minute session in early labor and were monitored for criterion measures every 15 minutes throughout labor. Some clients in both groups received Demerol and/or Largon.

A Hewlett Packard stethoscope and an Arden, aeroid sphygmomanometer were used to measure SBP and DBP. Pulse and R were timed for 15 seconds and EMG was obtained from the J33 Cyborg unit. Feedback was furnished by a repetitive click. The frontalis muscle was the site for EMG sensors.

Data analysis by the t-test revealed an $\alpha = 0.057$ level for the experimental versus control groups' EMG scores for Phase III of labor. Although statistical significance was not established, clinically the arithmetic data trend for EMG suggested that experimental subjects were able to lower frontalis muscle tension during labor which indicated that women were able to learn and apply information while in labor.

The findings supported the conclusion that no difference existed in the criterion measures for women who used and women who did not use continuous audio biofeedback during labor. Recommendations for further study include that the criterion measures and other physiologic measures such as galvanic skin response, oxygen

consumption, skin temperature, and EMG from several sites be measured throughout labor to determine which measure or measures reflect the response of the body to the stressors associated with labor.

Abstract Approved by: Committee Chairman [signature]

Program Director [signature]

Date 12/4/81 Dean of Graduate School [signature]

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CHAPTER I

THE PROBLEM

Background of the Problem

The process of childbirth produces physiological stress (Hytten and Thompson, 1965) and is identified as the most common type of stress experienced by women. Many women have little or no prenatal preparation for the experience, and for these women, the stress may be increased. Consequently, the labor room nurse is challenged to offer supportive care in assisting the woman to adapt to labor. Gillett (1977) speculated that the use of positioning, breathing patterns, mild analgesics and a supportive attitude for the mother and father-to-be facilitate progression in labor. However, Gillett offered no empirical evidence to support these conjectures. Nurses need to develop scientifically verified interventions to assist women in labor.

In the summary statement of an article dealing with the historical perspective of preparation for labor, Beck, Geden and Brouder (1979) identified a lack of interface between psychoprophylaxis literature and current psychological and physiological research dealing with reduction of stress, anxiety, and pain. Furthermore, this lack of continuity among literature dealing with stress, anxiety, pain, and labor is nowhere more apparent than in

the study of women who have had no prenatal preparation for labor. This paper describes an assessment of selected physiological parameters in the laboring gravida in response to the nursing intervention of continuous audio biofeedback.

Significance of the Study

The significance of this study lies in potential benefits to minimally prepared women in labor. Interventions are needed to assist women in coping with the physiological stress of labor so they may progress through labor more effectively and efficiently. Physiological stress during labor has been shown to influence not only the woman but also the fetus (Adamsons, 1975) and the family (Klaus & Kennell, 1976). Moreover, additional evidence indicated that experiences in labor influence the maternal-infant interaction post delivery (Sosa, Kennell, Klaus, Robertson & Urrutia, 1980).

Traditional nursing measures for assisting women to cope with labor include the use of intermittent verbal feedback, positioning, coaching with breathing patterns, back rubs, providing a clean and dry labor bed, and administering medications as ordered by the physician (Ziegel & Cranley, 1978). As technological advances are made in the health care field, nurses are challenged to incorporate new concepts into the delivery of nursing care. The nurse at the laboring woman's bedside must use knowledge and skill to assist the woman in reducing physiological stress. As information becomes available on potentially more effective and efficient methods of

dealing with physiological and psychological stress, nurses must endeavor to examine the application of these methods to clinical situations such as women in labor.

A common site for biofeedback on muscle tension is the frontalis muscle (Budzynski & Stoyva, 1969; Burish & Schwarz, 1980; DeGood, 1977; Fridlund, Fowler, Pritchard, 1980; Haynes, Moseley, & McGowan, 1975). This muscle is one of the most difficult muscles in the body to relax and has been shown to provide an indication of the degree of stress in the entire body (Kinsman, O'Banion, Robinson, & Staudenmayer, 1975; Nielsen & Holmes, 1980; O'Connell & Yeaton, 1981; Raskin, Johnson, & Rondestvedt, 1973). There are no studies reported in the literature on the use of frontalis muscle biofeedback during labor. This dissertation research was designed to develop information for nurses on the use of electromyograph (EMG) audio biofeedback with women in labor.

Theoretical Framework

The theoretical framework for the study was Selye's stress-adaptation theory. In his book, Selye (1978) specified that the relaxation response permits reduction of stress to the lowest possible level. Nielsen and Holmes (1980) referred to the use of EMG feedback-assisted relaxation training to develop an "anti-stress" response that individuals may use in stressful situations. As early as 1954, Jacobson advocated the use of progressive relaxation for women in labor. Hytten and Thompson (1965) suggested the

study of stress during pregnancy and childbirth to increase understanding of the stress response. Since the concepts of stress, relaxation, biofeedback, and childbirth were elemental to the study of women in labor, Selye's framework was suited to guide the study.

Statement of Purpose

The purpose of this study was to assess selected physiological parameters of the minimally prepared laboring gravida in response to the nursing intervention of continuous audio biofeedback.

Research Hypothesis

Women who use continuous audio biofeedback during the three phases of labor will have different systolic blood pressure (SBP), diastolic blood pressure (DBP), pulse rate (P), respiratory rate (R), and electromyograph scores (EMG) than women who do not use continuous audio biofeedback.

Assumptions

Assumptions underlying the study are as follows:

1. One of nursing's goals is to minimize the physiological stress resulting from labor.

2. The experience of labor is a stressor (Astbury, 1980; Beck, Geden, & Browder, 1979; Beck & Siegel, 1980).

3. The experience of labor is manifested in a variety of physiological responses.

4. EMG audio biofeedback assisted relaxation has potential for generalization to other muscle groups and physiological response systems (Nielsen & Holmes, 1980).

5. Successful EMG biofeedback relaxation training can be taught (Nielsen & Holmes, 1980; O'Connell & Yeaton, 1981).

6. Successful use of EMG biofeedback relaxation training may elicit an "antistress" response (Neilsen & Holmes, 1980).

7. Stress may be reflected by changes in blood pressure, pulse rate, respiratory rate, and electromyograph score.

Limitations

The researcher had no control over the participants' sociocultural values and psychosocial stress associated with labor. Additionally, staff nurses working with the client varied for study participants. Also, family members visited and remained with participants for varying lengths of time during labor. At the time each woman was invited to participate in the study, there was no way to predict the development of complications or the duration of each of the phases of the first stage of labor.

Definition of Terms

The following words germane to the study were defined:

Audio Biofeedback--Use of external disks to provide an individual with an audible tone which indicates the degree of tension of the frontalis muscle.

Audio Biofeedback training--A ten minute period in which the client was taught the act of being aware of frontalis muscle tension as evidenced by varying audible tones. Instructional procedures included demonstration, return demonstration, and practice (Appendix H).

Baseline data--Scores for the criterion measures taken two minutes after application of the biofeedback sensors.

Electromyograph (EMG)--A biofeedback instrument that reflects muscle activity by measuring the electrical impulses that cause the muscle fiber to contract (action potential).

EMG score--Values obtained from the actual reading of the action potential of the muscle as measured in microvolts (μV). The normal range for frontalis EMG activity is between three and ten μV (Cyborg, Note 2).

First stage of labor--The first stage of labor occurs as determined by cervical dilatation from one to ten centimeters (cm). The dilatation stage is divided into three phases:

a. Phase one (P I)--Cervical dilatation is one to four cm.
b. Phase two (P II)--Cervical dilatation is five to seven cm.
c. Phase three (P III)--Cervical dilatation is eight to ten cm.

FPAL--An abbreviation employed to describe parity using the following guide:

F--delivery of a full term infant.

P--delivery of a premature infant.

A--abortion prior to the 20th week of gestation.

L--number of living children.

Microvolt(μV)--An electrical measure equal to one-millionth of a volt.

Minimal preparation--Refers to a laboring client who has received two or less prenatal preparation classes.

Physiologic criterion measures--Actual values for a client's systolic blood pressure (SBP), diastolic blood pressure (DBP), pulse rate (P), respiratory rate (R), and electromyograph score (EMG).

Relaxation response--An integrated hypothalamic response which results in generalized decreased sympathetic nervous system activity (Benson, Dryer, & Hartley, 1978).

Stress--A state produced by all the nonspecific changes within a biologic system which appears as a specific syndrome (Selye, 1978).

Study nurse--The researcher who carried out the research design.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Topics appearing in the literature review include Selye's theoretical framework, the physiological stress of labor, and biofeedback and relaxation. Information from each of these themes is pertinent to the study of the use of audio biofeedback with women in labor. Since Selye's stress-adaptation framework provides the theoretical guidance for the study, the first section of Chapter II contains a discussion of the pertinent aspects of the framework. Next appears information regarding the physiological stress of labor. The final section of Chapter II contains a discussion of biofeedback and relaxation.

Theoretical Framework

Concepts in Selye's theory important to this study are stress, eustress, distress, adaptation, adaptation energy, the general adaptation syndrome (GAS), and conditioning factors. Selye (1978) defined stress as a state produced by all the nonspecific changes within a biologic system which appear as a specific syndrome. According to Selye, there are many factors or stressors that may produce stress. Some examples of stressors identified by Selye include muscles adapting to hard work, nervous system coordination

for exacting tasks, and connective tissue fighting bacterial invasion. The presence of stressors over a long period of time results in the appearance of a triadic stress reaction--adrenal stimulation, thymicolymphatic atrophy, and gastrointestinal ulcers--in the human body.

Stress may be classified as eustress or distress depending on the stressors. Eustress refers to a less damaging form of stress caused by pleasant conditions such as winning a ballgame, a passionate kiss, or a game of tennis. On the other hand, distress alludes to unpleasant or harmful factors which contribute to the syndrome. Some examples of distress include failure, humiliation, and infection. Selye (1978) mentioned the importance of an individual's response in determining the degree of damage resulting from stress and emphasized that "how you take it" determines successful adaptation to change. Also, Selye specified that the relaxation response permits diminution of stress to the lowest possible level.

Selye (1978) presented stress as an adaptive reaction and therefore a basic feature of life. In each situation, an essential feature of adaptation is confining stress to the smallest response possible to meet the demands. Each individual's amount of adaptation energy is finite, and perhaps this is the reason for conservation of bodily reactions. Selye remarked that the length of life appears to be determined by availability of adaptation energy and that people use their reserve at different rates. Moreover, Selye observed that an eventual result of adaptation is exhaustion or the loss of power to resist.

A model employed by Selye to depict adaptation is the triphasic GAS. This syndrome encompasses all nonspecific changes throughout the time of continued exposure to a stressor. Selye (1978) compared stress to the GAS by describing stress as a snapshot and the GAS as a motion picture. The three stages of the syndrome are the alarm reaction (AR), the stage of resistance (SR), and the stage of exhaustion (SE). Each phase of the GAS denotes a degree of the body's reaction to stress. In the AR stage adaptation is not yet acquired, while in the SR stage adaptation is optimal. During the final stage, SE, the acquired adaptation is lost and death ensues. The evolution of the three stages reflects Selye's belief that adaptability is finite and may lead to exhaustion.

Selye emphasized that there is stress at any moment during the stages but that manifestations vary over time. Also, Selye maintained that stressors cause changes corresponding only to the first and second stages and that individuals go through these two stages a great many times. In addition, Selye discussed the additive nature of the nonspecific effects of various stressors acting simultaneously. Selye (1978) noted that the body responds proportionately to the intensity of aggression and compared the additive nature of stress to the responses for single and multiple alarm fires. A small flame causes an alarm that dispatches a few trucks while a large fire triggers alarms that hastens many units to the blaze. Selye's fire illustration can be applied to describe the effects of progress in labor. The labor process begins as a small blaze and develops into a raging wildfire.

Conditioning factors alter the body's resistance to stress. In Selye's stress framework, two conditioning factors--internal and external--are discussed. Internal conditioning factors incorporate into the body and include examples such as heredity and past experiences. External conditioning factors consist of phenomena which act upon the body such as climate and diet. Selye viewed conditioning as an important aspect of the stress framework since it plays a role in the body's resistance.

The events associated with labor can be viewed as stressors which produce nonspecific changes in the woman. A major stressor during labor is the work of the woman's uterus to expel the products of conception. Additional stressors occurring at the same time challenge the woman's nervous system to respond. Since stressors cause adrenal stimulation, the effect of these stressors on the woman can be measured in changes in SBP, DBP, P, R, and EMG. The sum of these measures would show the total effect of the stressors on the woman in labor.

Using Selye's framework, the level of resistance to the stressor of labor would be expected to rise for the non-prepared laboring client. As the woman progresses through each phase of labor, additional stressors cause the level of resistance to rise to a higher plateau. Conversely, an intervention could be utilized to assist the woman in adapting to labor and result in a smaller rise in the plateau level of resistance. An external conditioning factor such as relaxation with biofeedback may assist the client to adjust to labor. The goal for the intervention follows Selye's

theory and is to assist the woman to use the smallest amount of energy possible to deal with labor.

Physiological Stress of Labor

Hytten and Thompson (1965) identified pregnancy as the most common type of physiological stress among women. These authors pointed out that the study of stress during pregnancy and childbirth may lead to increased understanding of the stress response. Cogan (1974) discussed the woman's use of learned techniques during the first stage of labor. During prenatal classes women learned an approach to labor that would allow them flexibility in using the techniques throughout labor. Participants responded to three questionnaires during their prenatal education and post delivery. These women reported that they practiced breathing exercises for 21-30 minutes per day. Although the instructional material suggested the use of rapid breathing techniques during P III, women in the Cogan study reported application of rapid breathing throughout P I, P II, and P III. Additionally, these women said that the techniques they used in early labor were more helpful than techniques used later in labor. Panting (rapid breathing) was reported to be the most helpful technique used throughout labor.

Sosa et al. (1980) reported that a relationship exists among the presence of a supportive companion, perinatal problems and mother-infant interaction. Also, these authors indicated that studies on labor must ensure that all groups of women being studied receive the same amount of time and support from nurses and medical

professionals. Women in the Sosa et al. (1980) study who had a human companion experienced a shorter labor and enhancement of maternal behaviors during the first hour after delivery. In addition, women with companions developed fewer problems that required intervention than did women who did not have companions.

Lederman, Lederman, Work, and McCann (1978) examined the relationship of maternal anxiety, plasma catecholamines, and plasma cortisol to progress in labor. Thirty-two married, primigravidas from 20 to 32 years of age participated in the study. Data presented in the report showed that physiologic elevations of plasma epinephrine are associated with lowered uterine activity and a longer duration of labor. Furthermore, Lederman et al. (1978) pointed out that epinephrine is highly responsive to anxiety and concluded that there is a relationship among maternal anxiety, epinephrine and progress in labor.

In a study of the effects of administration of catecholamines to the mother upon fetal asphyxia in the rhesus monkey, Adamsons, Mueller-Heuback and Myers (1971) stated that the extent to which stress related states during pregnancy or during labor may lead to release of sufficient quantities of catecholamines to reduce intervillous space perfusion is unknown. Additionally, these authors report that the administration of epinephrine to the pregnant monkey resulted in an increase in uterine activity in the majority of cases. Additionally, Adamsons et al. (1971) found that increases in SBP and DBP in pregnant rhesus monkeys tended to be

more pronounced when the blood pressures prior to infusion of catecholamines were low.

Maltau, Eielsen, and Stokke (1979) studied the effect of stress during labor on the concentration of cortisol and estriol in maternal plasma during the different stages of labor. The authors compared the use of epidural anesthesia versus conventional analgesia (pethidine 100 mg intramuscularly and/or diazepam ten mg orally) in 15 healthy primiparous women. These authors labeled the nonepidural group as the "stressed" group and the epidural group the "nonstressed" group. The researchers reported a significant increase in the plasma cortisol level from the initial measure early in labor to the second stage ($p < 0.05$) in the "stressed" groups while the "nonstressed" group had a slight and insignificant rise in cortisol.

Biofeedback and Relaxation

Biofeedback is extolled by some as a new wonder for solving health problems (Brown, 1974). Other authors hold more conservative views (Astor, 1977; Blanchard & Young, 1974; Miller, 1978) on the therapeutic application of biofeedback. Miller (1978) suggested that rigorous studies are needed to provide evidence that a therapeutic effect is produced by biofeedback. In addition, Miller said biofeedback must evidence as much, or more, therapeutic value than presently used treatment modalities. Blanchard and Young (1974) stated that the same standard that applies to the introduction of a new drug or a new form of psychotherapy should be used to evaluate the efficacy of biofeedback.

The term biofeedback resulted from taking a portion of the word "biology" and the term "feedback" from cybernetics. "Bio" refers to the type of system involved in the process. "Feedback" signifies input into the system in the form of output from the same system for the purpose of self-correction (Astor, 1977). Since the body, a biological unit, is the system which produces output and receives feedback, the term "biofeedback" evolved.

Application of the technique of biofeedback provides an individual with auditory or visual information regarding some physiological function (Winer, 1977). Auditory information may be presented by a buzzer, a series of clicks, or variations in tone (Wolf, 1978). Some threshold units have a monotone buzzer that is activated when function reaches a certain level. Another devise utilizes a series of clicks that occur more frequently as activity increases. Additional units provide a tone that increases in pitch as activity increases. In some other units, visual feedback appears on an oscilloscope screen, by single or multiple flashing lights, or by meter deflection (Wolf, 1978).

The purpose of biofeedback is to provide an individual with information that can be used to gain additional control of bodily processes (Winer, 1977). Feedback provides moment-to-moment information which otherwise would not be available to an individual (Miller, 1974). Through biofeedback, the person gains an additional parameter of self-awareness and an appreciation of an ability to exercise control over the body.

An outstanding and perhaps most attractive feature of biofeedback is promotion of self-reliance (Miller, 1978). According to Astor (1977) and Budzinski (1973), the three main goals of biofeedback are awareness, control, and transfer. Using feedback, the individual becomes aware of some aspect of his body. Once the person receives information on a specific process, he learns control through altering biophysiological and/or psychological states to achieve self-control. In the Budzinski (1973) paradigm, the third goal of transfer refers to the ability to apply principles learned in a laboratory to real life situations. In health promotion, the application of learned principles to life stresses is of prime importance. Fuller (1978) emphasized that the underlying philosophy of biofeedback is to return responsibility to the individual.

Principles from the field of physiology, psychology, electronics, and information theory are used in biofeedback (Winer, 1977). Fuller (1978) called attention to the lack of unification of psychological and physiological factors by medical and psychological communities. Sterman (1975) indicated that traditional clinical medical practice directs efforts to the cure of diseases. In addition, the client plays a passive role while things are done to him, for him, and/or in spite of his efforts. The converse is true in biofeedback as the client must play an active role in prevention or recovery. Participation by the client is long range and lasts over weeks or months and perhaps years, and in some instances biofeedback devices are altered for home use.

Haynes et al. (1975) described a study which compared the effectiveness of frontalis EMG biofeedback and relaxation instruction in reducing EMG levels. In the study, the authors randomly assigned university students to five groups: (a) frontalis EMG biofeedback (auditory variable frequency feedback), (b) passive relaxation instructions (attending to and relaxing muscles), (c) active relaxation instructions (tensing and relaxing muscles), (d) false feedback, and (e) no treatment control. In a single, 20 minute session design, subjects who received biofeedback and passive relaxation instructions demonstrated the greatest decrement in frontalis EMG level. The biofeedback group produced significantly lower levels of EMG activity and decreased EMG activity faster than the other groups. The authors indicated that biofeedback may be useful in behavior therapy which relies on muscle relaxation.

Sallis and Lichstein (1979) studied the length of time required for group mean EMG stabilization in 17 undergraduate students. These authors found that the group mean EMG stabilized within 12 to 15 minutes. The authors did not discuss the stabilization effect with use of other techniques. It is important to mention that no intervention was introduced. The students in the study were placed in a recliner and left alone for a 15 minute period. Perhaps these students left to their own devices and given the time indeed became more relaxed rather than merely adapting to the EMG sensors.

In a study on resting EMG level to total body metabolism DeVries, Burke, Hopper, and Sloan (1976) examined general resting muscle activity and oxygen consumption. The results support earlier findings that the electrical state of the right arm flexors provides an indication of the functional state of the organism. In a second study by these authors (1977) the right brachial biceps was found to have the highest ability to indicate general muscular tension.

Frazier (1974) discussed a prenatal relaxation program employing multi-modal-biofeedback used by his wife from the seventh month of pregnancy through delivery. A tri-bio-sensor unit provided information on EMG, skin surface resistance (galvanic skin response or GSR), and skin temperature on an alternating basis. During practice sessions, Frazier's wife switched from GSR to EMG and to skin temperature for feedback. She practiced biofeedback each evening before retiring and used it to promote relaxation throughout labor with assistance from her husband. During labor, she received no pain medication; however, for delivery she had a saddle block. She reported that she found "the total delivery very easy and almost a pleasant sensation."

In a study by Gregg (biofeedback training, 1975) women used biofeedback to assist with relaxation during pregnancy and labor. Gregg instructed the women to use the biofeedback twice a day for 30 minutes until they could reduce the pitch at will by simply relaxing. Gregg then compared the amount of medication, length of labor, and newborn Apgar scores for 30 women from his practice to

30 matched control subjects delivered by another obstetrician. Both primiparous and multiparous women were included in the study. Women who used biofeedback required fewer drugs and progressed more rapidly in labor than did the untrained women. No difference existed in the Apgar scores for infants delivered by women from the two groups. Greater differences appeared in the amount of drugs taken by untrained multiparous women as compared to their counterparts. Gregg stated that biofeedback increased the woman's confidence that she would be able to relax during labor.

Paul (1969) conducted a study on 60 undergraduate females comparing the effects of two one hour sessions of hypnotic suggestion and brief relaxation training on subjective tension and distress and physiological response. The measures of physiological response were P, R, tonic muscle tension, and skin conductance. Both relaxation training and hypnotic suggestion resulted in significantly greater effects than controls. The relaxation training group produced significantly greater decreases than the control group on physiological measures from the first session through the second session. Additionally, the relaxation training group produced significantly greater reductions than the hypnotic suggestion group in heart rate and tonic muscle tension. Paul concluded that both hypnotic suggestion and abbreviated progressive relaxation training do result in decreases in physiological arousal and subjective distress within one to two sessions. Furthermore, Paul stated that progressive relaxation training is more effective

than hypnotic suggestion in decreasing physiological arousal when considered in terms of efficiency of treatment and intensity and extent of results.

Yorkston and Sergeant (1969) conducted a study utilizing a simple method of relaxation with 92 psychiatric patients. All but three of the participants using the method were relaxed within two minutes. Later, 58 of the participants used the method to relax. The aim of the study was to relax each participant during the first session of ten to 30 minutes. Yorkston and Sergeant identified as intervening variables that all patients knew the investigator as their physician and that observer bias may have resulted in judging a higher proportion of patients as relaxed.

Kondo, Canter, and Bean (1977) mentioned that while great attention has been focused on the application of the techniques of EMG biofeedback relaxation, the learning aspects of the situation and parameters affecting learning have been somewhat ignored. Using 24 normal subjects, these authors focused on the influence of intersession variation on relaxation. Conclusions drawn as a result of the study were that either the first or last five minute period of training provided an accurate account of EMG decreases over time and shorter periods between training sessions enhanced the rate and amount of EMG reduction.

Ohno, Tanaka, Takeya, Matsubara, Kuriya and Komemuski (1978) found that changes in EMG did not correlate with P changes but did correlate with changes in R. There were 20 normal subjects who were randomly divided into two groups. Both groups received five

training sessions of approximately 40 minutes' length on each of five different days. The EMG levels dropped markedly from the first to the last sessions for these normal subjects.

Fee and Girdano (1978) studied 54 college students to determine the relative effectiveness of EMG, meditation and progressive muscle relaxation. Measures used to evaluate the methods were frontalis muscle tension, P, electrodermal response, R, and skin temperature. The comparisons showed that the EMG biofeedback group had significant decreases in muscle tension but no significant differences in the other measures. Colgan (1977) studied the control of P and found that subject's R was increased when the P was faster. Lehrer (cited in Shapiro and Lehrer, 1980) suggested that physiological changes produced by relaxation are measureable only in a highly anxious person. Stilson, Matus and Ball (1980), in an experiment with frontalis EMG biofeedback, reported that there is an increased accuracy of frontalis control in deep relaxation.

Davidson and Neufeld (1974) examined the human response to pain and stress and found that individuals experiencing pain responded with increases in EMG and R. Therefore these authors concluded that relaxation procedures are more effective than cognitive procedures in increasing pain tolerance and the converse is the case for stress tolerance.

Much controversy exists over the use of EMG biofeedback assisted relaxation. Some reports (Alexander, 1975; Alexander, White & Wallace, 1977; Fridlund, Fowler & Prichard, 1980; Shedivy &

Kleinman, 1977) indicated that there is no transfer of training from one muscle group to another. Other authors (DeGoode, 1977; Nielsen & Holmes, 1980; O'Connell & Yeaton, 1981; Stilson et al. 1980) supported the notion that transfer effects or generalization to other muscle groups do exist. Studies conducted using EMG biofeedback (Fridlund et al. 1980; Reinking & Kohl, 1975; Sime & DeGood, 1977; Stern & Berrenberg, 1977) as an intervention to assist relaxation and studies which examine the tenants of EMG biofeedback (Alexander, 1975; McGowan, Haynes & Wilson, 1979; Nielsen & Holmes, 1980; O'Connell & Yeaton, 1981) offer inconclusive evidence as to the efficacy of the method. The most recent literature (Naliboff & Johnson, 1978; Stilson et al. 1980) suggested that the control of the frontalis muscle differs from that for the right forearm extensor muscles.

Additional contention exists over the relationship between EMG biofeedback assisted relaxation and variance of P (Colgan, 1977; Ohno et al. 1978; Travis, Partlow, Bean & Kondo, 1980), R (Colgan, 1977; Davidson & Neufeld, 1974; Travis et al. 1980), and SBP and DBP (Fey & Lindholm, 1978; Frost & Holmes, 1980). Much of the research thus far conducted compares use of EMG assisted biofeedback relaxation and traditional relaxation techniques in simulated laboratory settings. The induced physiological stress consisted of either electrical shock (Burish & Schwartz, 1980; Suess, Alexander, Smith, Sweeney & Marion, 1980), or pressure algometer (Davidson & Neufeld, 1974).

Examples of fabricated psychological stress include visualization of a feared situation (McGowan et al. 1979) and viewing a stressful film (Nielsen & Holmes 1980). Clinical studies have illustrated the use of EMG feedback assisted relaxation with tension headaches (Raskin, Johnson, & Rondestvedt 1973), during dental stress (Winer, 1977), anxiety neurosis (Canter, Kondo & Knott, 1975), test anxiety (Reed and Saslow, 1980), and hypertension (Schwartz, 1973).

Several authors have reported the importance of relaxation as a part of prenatal education (Chertok, 1969; Cogan, Henneborn, & Klopfer, 1976). Jacobson (1954) advocated learned relaxation as being completely sufficient to provide pain relief during at least the first stage of labor. There are no reports of the use of planned relaxation for minimally prepared women. The studies reviewed thus far indicate that relaxation can be taught in a single session lasting from two to 20 minutes. Also, the study by Haynes et al. (1975) indicated that biofeedback facilitates learning relaxation.

Summary

Due to many factors, a woman may respond to labor by resisting the process or by working in concert with the forces in her body. Women who have no preparation for labor may be unaware of ways to work with the body and may actually impede progress in labor. Thus, they may require more energy to adapt to labor and cause more stress to their bodies. These women need assistance in adapting to

the stressors associated with labor. Based on the aforementioned studies, the investigation of the application of audio biofeedback during labor as a nursing intervention was reasonable.

CHAPTER III

DESIGN AND METHODOLOGY OF THE STUDY

Introduction

The segments of Chapter III include a description of the manner in which the study was conducted. The initial section, "Sample Source and Selection," contains a discussion of sample criteria, origin, and the selection process. Next, the "Procedure" division is comprised of an account of the data collection process. The third section, "Instrumentation," has a report of the characteristics of the data collection apparatus and audio biofeedback device. In the final part, "Analysis of Data," the approach used to treat statistically the data is presented.

Sample Source and Selection

Since the study was aimed at obtaining information about minimally prepared gravidas in labor, data were collected at two large metropolitan hospitals located in the Southeastern United States. Prenatal classes were offered at some but not all of the several clinics the participants attended. No mechanism existed to assure that the subjects' consent for the study could be obtained prior to being admitted to the hospital.

In the original proposal, only primigravidas were included in sample criteria. However, to facilitate data collection, gravidas who had previously aborted prior to the 20th week of pregnancy were allowed in the study.

All data were collected in the labor and delivery suite of one of the two hospitals. Some of the subjects were in semi-private labor rooms and a few were in private labor rooms.

The following sample criteria were used to evaluate potential participants:

Criterion	Parameters
Age	16 to 40 years of age
FPAL	0000 or 0010
Dilatation	0 to 4 cm.
Prenatal classes	No more than two
Complications	None
Anesthesia	No plans for epidural anesthesia
Biofeedback	No previous experience

Women who met all of the criteria were invited to participate in the study. Subjects were assigned to the control and experimental groups according to a random schedule (Appendix E) drawn from a table of random numbers. This type of assignment was done to assure randomization of the sample.

In order to identify potential participants and facilitate data collection, all shifts of the labor and delivery staff of the two hospitals were informed of the study. Staff members were given

a brief overview of the study and questions were invited and answered. A copy of the human use proposal was placed with reference books on both units. Sample criteria were posted in a prominent place and the staff were asked to call the study nurse should gravidas who met the criteria enter the hospital. Additionally, at various times during data collection, the study nurse called, visited, and/or remained on each of the labor and delivery units to talk with the staff as well as identify possible subjects.

Data collection occurred during all hours of the day for both control and experimental participants. Much of the data were collected in July through October of 1979 while the remainder data were collected from June through September of 1980.

Procedure

Prior to actual data collection, a pilot study was conducted. The experimental and control protocols were each followed with one participant. A need for detailed protocols to guide data collection was identified during the pilot project and both protocols were subsequently refined before actual data collection. The detailed protocols appear in Appendices J and K.

The human rights of all participants were protected by the following procedure. The proposed study was reviewed in accordance with the guidelines established by the Institutional Review Board of the University of Alabama in Birmingham, and the review board of the institutions where data were collected. Letters of consent were sent to the Director of Nursing Service of the hospitals

(Appendix A) and to obstetricians (Appendix B) who admit women to the obstetrical unit. Clients who met study criteria were invited to participate in the research. The study nurse explained to each potential subject that the nursing care they received was in no way influenced by participation or non-participation in the study. The study nurse explained that the woman could withdraw from the study at any time without affecting care given by staff nurses and that the study nurse was not a regular staff member of the hospital and was not reimbursed by the hospital for the research.

Between June of 1978 and September of 1980, women entering the labor unit who met sample selection criteria were invited to participate in the study. Once a potential participant was identified, the woman was approached by the study nurse who identified herself, explained the study, provided a consent form, read the consent form, and invited questions about the study. Subsequently, the study nurse left the room for five minutes. Upon reentering the room the study nurse again invited questions about the study. After answering all questions, the study nurse asked for the woman's decision regarding study participation. When a woman consented to enter the study, she was asked to sign the appropriate consent form (Appendices C & D). A copy of the consent was given to the woman and a copy retained by the study nurse.

Information collected on all participants appears on the data sheet (Appendix F) and included criteria for participation, as well as factors which could have influenced study results. Factors

recorded that could have produced alterations in the criterion measures were attendance at any prenatal classes, number of classes attended, medications administered during labor, and cervical dilatation as estimated by hospital resident staff.

The desired position for the client was the left lateral sims position. However, obtaining all measures with the client in the same position was not practical or possible due to the duration of labor and each individual's response to the process of labor.

During data collection some participants changed positions more frequently than others. However, all recordings were taken from either the right or left arm with the client in a side-lying or semi-side-lying position. Blanket rolls were used to keep participants in a partial right or left side-lying position throughout labor.

Before collecting each data set, the study nurse evaluated the woman for uterine contractions. If a contraction was apparent, the study nurse waited until one minute past the contraction to collect data.

Data collection was discontinued on women who had unexpected Pitocin stimulation of labor, requested epidural anesthesia, exhibited fetal heart rate decelerations and/or required cesarean section delivery. One study participant indicated that she had seen a film on labor at school; however, data were not collected on films, books or other instructional material used by participants. The researcher decided to count viewing the film as one class on labor.

Audio biofeedback disks were applied in the same manner for the control and experimental subjects. The skin was prepped with an alcohol swab and the three disks were placed on the forehead. Each disk was covered with a double stick adhesive ring, filled with conductive jelly, and the jelly leveled with the top of the disk. The cover of the adhesive ring was then removed and the disk adhered to the forehead. The black tipped disk was always placed between the two white tipped disks. A detailed procedure for the application of the disks is outlined in Appendix G.

The following procedure was used for data collection from control group participants. Once a woman consented to participate, the biofeedback disks were placed on the frontalis muscle and the speaker wires were disconnected from the biofeedback machine. After the biofeedback unit was set up, the study nurse waited a period of two minutes to allow the woman time to become accustomed to the feel of the disks and then began data collection. The first set of recordings were baseline data. The study nurse then waited a period of 15 minutes to obtain the next set of data. The timing for the second data set was planned to coincide with the second data set obtained from the experimental group.

The following procedure was implemented for experimental participants. Biofeedback disks were attached, and after waiting a period of two minutes, the study nurse collected baseline data. Subsequently, instructions for audio biofeedback (Appendix H) were presented to all experimental subjects. The instruction session included a description of the possible benefits of the use of audio

biofeedback to reduce stress, guidance regarding positioning, discussion of the meaning of the clicking sound, and directions to wrinkle the forehead so as to speed the clicking and relax the forehead to slow the clicking. Subjects were asked to lie quietly for ten minutes, to let their body be limp, and to listen to the sound from the machine. Additionally, subjects were reassured that they would not be left alone during the practice or their labor. At the end of the ten minute session the criterion measures were recorded.

At hourly intervals after the initial teaching session, the study nurse provided a review session which is outlined in Appendix I. In the review session, experimental subjects were asked if they could hear the biofeedback signal, and informed of the level of muscle stress while at rest and during a contraction. Finally, the subjects present level of muscle stress was compared to the initial session level.

Immediately upon completion of the initial session the study nurse recorded each criterion measure. Additional recordings of criterion measures were collected at 15 minute intervals throughout labor. All criterion measures were taken after the hourly review sessions. The audio biofeedback unit remained operational throughout the participant's labor unless the woman withdrew from the study, was excluded from the study due to complications during labor, or the woman requested epidural anesthesia.

Instrumentation

A Hewlett Packard stethoscope and an Arden aeroid sphygmomanometer was used to obtain SBP and DBP. The SBP and DBP sounds were identified according to the guidelines of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (Moser, Guyther, Finnerty, Richardson, Langford, Perry, Wood, Krishan, Branche & Smith, 1977) and the guidelines presented by Lancour (1976) in an article "How to avoid pitfalls in measuring blood pressure." The SBP was identified as Korotkoff sound I and DBP used was Korotkoff sound V.

A watch with a second hand was used to time P and R. A radial P was counted for 15 seconds and multiplied by four to produce a P per minute. Respiratory rate was taken by observing the rise and fall of the anterior chest wall for 15 seconds. The R per minute was calculated by multiplying the 15 second rate by four. Counting the P and R for a full minute was not possible since contractions occur every two to five minutes during P II and P III of labor.

The EMG J 33 biofeedback unit, manufactured by the Cyborg Corporation, was used to measure the EMG score from the frontalis muscle. The machine's dimensions are 18 by five by ten cm, and weight is approximately 0.5 kg. Power was provided by two 9 volt, alkaline, transistor batteries (Burttram & Robinson, Note 1).

The machine measures muscle activity in μV. Studies (Coursey, 1975; Kinsman et al. 1975; Sime and DeGoode, 1977; Stern, 1977) support use of units similar to the J 33 to measure true action potentials. High muscle stress indicates increased muscle activity which Selye (1978) called an indication of stress.

Disks of 1.4 cm. in diameter were used to measure the muscle activity. The disks were totally non-intrusive and were held in place by adhesive circles. One disk was specifically for grounding purposes to increase the accuracy of the recordings and two disks actually measured muscle action potentials. Since the machine was battery powered, a grounding device was not required. No electrical activity passed to the participant's body. The biofeedback unit was equipped with an audio switch with two positions. Position A produced a tone elimated through the use of position B which created a repetitive click that increased as the muscle activity increased. For the control group the instrument only monitored the body's activity. For the experimental group, the instrument was used to give continuous audio biofeedback in the form of repetitive clicks.

Analysis of Data

The Statistical Package for the Social Sciences (SPSS) was used for data analysis. A program was designed for the analysis of data.

Since data were analyzed according to the categories of baseline, P I, P II, and P III, the potential number of data sets for each category was identified. Baseline data were collected once and therefore required one entry set.

The possible number of data sets for P I was estimated to be 18 which provided for the woman to labor for four and one-half hours in P I. An uncomplicated, hospitalized, laboring woman's

cervix usually dilates at approximately one centimeter per hour (Jensen, Benson, & Bobak, 1980).

Phase II was alotted 16 data collection points since four hours would allow for the client to progress from five to seven centimeters of dilatation at slightly less than one centimeter per hour. The final phase, P III, was assigned ten data sets which provided for two centimeters of dilatation in two and one-half hours.

All data cards contained the client's number in the first two spaces and the card number in the last two spaces. Each client's data filled 14 computer cards.

Missing values were identified for all demographic data and criterion measures. Variations in the length of labor and progress in labor, as well as procedures such as vaginal exams, radiography, sonography and application of internal fetal scalp electrode and internal pressure catheters prevented data collection at every designated collection point on each client.

In the clinical setting, data were recorded on a collection sheet (Appendix F). Subsequently, data were transferred to Fortan statements and computer cards were punched.

After data were collected on 15 clients, frequencies were run on all variables so program errors and misplaced variables could be identified and corrected. Additional frequencies were run for error correction after data collection was completed on all 40 clients.

After all errors were corrected the data were compared by each data collection set. Since criterion measures were not available for every data set in every phase on every subject, comparison on a set by set basis was not possible. Therefore, criterion measures for each phase were averaged and the average scores were compared by the t-test.

CHAPTER IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

Introduction

Information contained in Chapter IV includes a description of the sample and a report of findings, conclusions, and implications. The description of sample segment includes a review of the characteristics of the subjects. In the findings, conclusions, discussion and implications section, the statistical hypotheses are stated, results presented, statistical significance reported, and application of the results to nursing expressed.

Description of the Sample

Of the 40 women in the study, 39 were primigravidas while one woman had carried a previous pregnancy that ended in a spontaneous abortion prior to the 20th week of gestation. The ages of the women in the control group ranged from 17 to 23 years of age, whereas the ages of the 20 experimental subjects ranged from 16 to 23 years (Table 1).

Table 1

Frequency Distribution of Age of Subjects

Age in Years	Control Group	Experimental Group	Both Groups
16		1	1
17	1	1	2
18	9	5	14
19	5	5	10
20	2	4	6
21		1	1
22	1	2	3
23	2	1	3
Total	20	20	40

A total of four women from the sample attended childbirth classes and of these, three attended one class whereas one attended two classes. Of the women attending classes, two were in the control group and two were in the experimental group. None of the women in the sample had received previous teaching about biofeedback.

At the time each woman signed the consent form, her cervix was four centimeters of dilatation or less. Additionally, all of the women initially stated they did not plan to use epidural anesthesia, although some later opted to use epidural anesthesia. Once the procedure to administer the epidural anesthesia was initiated, data collection was discontinued.

A total of three women were sent home from the hospital after data collection commenced. Data collected on these women were included in the analysis of data since all of these women returned to the hospital and delivered a viable newborn within two to four hours after discharge from the hospital. Two control participants and three experimental participants had variable or late fetal heart rate decelerations during labor. Once the woman was informed of the fetal heart rate decelerations, data collection was discontinued, but collected data were used in analysis.

The total amount of time that subjects remained in the study varied from one hour to eight and one-half hours. The women progressed through labor at different rates. Data collection was discontinued on three control subjects and four experimental subjects due to the introduction of Pitocin stimulation of labor. All data collected on these women prior to pitocin therapy were included in the analysis of data.

The overall cesarean section rate for subjects in the study was 7.5 percent - zero for control participants and three for experimental participants. Data collection was suspended once the participant was informed of the necessity of having a cesarean section.

As evident from the preceding discussion of the development of complications during labor, criterion measures were not collected for all 40 participants for each data collection set in all phases of labor. Additionally, the number of data sets from each phase varied from subject to subject due to the variation in length

of labor. Recordings were made of some but not necessarily all of the criterion measures for each data set; therefore, the number of clients for which data were collected for each criterion measure varies. The number of subjects for whom criterion measures were collected and compared in the between group analysis is presented in Table 2.

Table 2

Number of Subjects Monitored by Phases, Groups and Criterion Measures

Phase	Group	SBP	DBP	P	R	EMG
Baseline	C	18	18	18	18	18
	E	16	16	16	16	16
Phase I	C	18	18	18	18	18
	E	11	11	11	11	11
Phase II	C	15	15	15	15	15
	E	13	13	12	12	13
Phase III	C	11	11	11	11	11
	E	12	12	11	10	12

When data between phases were analyzed separately for the control and experimental groups the number of subjects varied between phases since some women progressed rapidly in labor or were excluded due to complications. Comparisons were based on the number of subjects for whom data were available for both phases

being analyzed. For example, in the control group data were recorded for 17 subjects for both baseline and P I, consequently, that comparison contained data for 17 subjects. Although data were recorded for 18 subjects at baseline and P I, only 17 subjects had data available for both baseline and P I. The number of subjects for the within group comparisons are reported in Table 3.

Table 3

Number of Subjects for Within Group Comparisons According to Phases and Groups

Phase	Number of Control Group Subjects	Number of Experimental Group Subjects
Baseline to Phase I	17	9
Phase I to Phase II	13	8
Phase II to Phase III	11	7

Control participants received a total of 275 mg of Demerol and 140 mg of Largon and experimental participants received a total of 225 mg of Demerol and 120 mg of Largon (Table 4). A total of 11 control subjects received Demerol while eight experimental subjects received Demerol. Largon was given to six control and six experimental subjects. Table 4 contains an account of the amount of medication administered according to group and phase.

Table 4

Amount of Demerol and Largon in Milligrams According to Phases and Groups

Phase	Group	Amount of Demerol	N Receiving Demerol	Group Phase Total Demerol	Amount of Largon	N Receiving Largon	Group Phase Total Largon
B	C				20	1	20
	E	25	1	25			
P I	C	25	3	75	20	2	40
	E						
P II	C	25	7	175	20	3	60
		25	6				
	E	50	1	200	20	6	120
P III	C	25	1	25			
	E						
All Phases Total	C		11	275		6	140
	E		8	225		6	120

Data were analyzed to determine the effect of the analgesic medications on subjects' criterion measures. The Mann-Whitney U test was used to determine the effect of Demerol, Largon, and the combination of Demerol and Largon on the criterion measures. Data were analyzed according to the phases of labor and the medication administered during the previous phase. Analysis was set up by this scheme since the medication has a maximum effect from 30 to 60 minutes after administration. Therefore, the medication clients received during P I was analyzed for its effect on the P II criterion measures.

The control group's R during P II was lowered to a statistically significant degree by the Demerol. The other criterion measures showed no significant response to the analgesic medication. Tables 5 through 8 report the effects of the Demerol on the control and experimental group's criterion measures. Analysis of the effects of Largon on the criterion measures for both groups are reported in Tables 9 through 12. The effects of the combination of the drugs Demerol and Largon for both groups are reported in Tables 13 through 15. There are no tables for the control and experimental subjects for phases when no medication was given to subjects.

Table 5

Control Group Report of the Analysis of the Effect of Demerol from Phase I to Phase II

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	3	17	-1.2173
DBP	3	17	-0.0529
P	3	17	-0.8997
R	3	17	-0.6353
EMG	3	17	-1.1114

Table 6

Control Group Report of the Analysis of the Effect of Demerol from Phase II to Phase III

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	7	13	-1.2785
DBP	7	13	-0.8031
P	7	13	-0.7988
R	7	13	-2.2495*
EMG	7	13	-0.6425

*$\alpha = 0.05$

Table 7

Experimental Group Report of the Analysis of the Effect of Demerol from Baseline to Phase I

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	1	19	-0.5209
DBP	1	19	-0.1745
P	1	19	-0.8678
R	1	19	-0.3489
EMG	1	19	-0.8678

Table 8

Experimental Group Report of the Analysis of the Effect of Demerol from Phase II to Phase III

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	7	13	-0.5159
DBP	7	13	-0.9127
P	7	13	-0.6366
R	7	13	-1.0042
EMG	7	13	-0.4365

Table 9

Control Group Report of the Analysis of the Effect of Largon from Baseline to Phase I

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	1	19	-0.2602
DBP	1	19	-0.2603
P	1	19	-0.1736
R	1	19	-1.1315
EMG	1	19	-0.6070

Table 10

Control Group Report of the Analysis of the Effect of Largon from Phase I to Phase II

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	2	18	-0.5040
DBP	2	18	-0.7559
P	2	18	-1.1339
R	2	18	-1.0083
EMG	2	18	-1.0079

Table 11

Control Group Report of the Analysis of the Effect of Largon from Phase II to Phase III

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	3	17	-0.1601
DBP	3	17	0.000
P	3	17	-0.0533
R	3	17	-0.1610
EMG	3	17	-0.8045

Table 12

Experimental Group Report of the Analysis of the Effect of Largon from Phase II to Phase III

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	6	14	-0.1652
DBP	6	14	-1.4042
P	6	14	-1.1181
R	6	14	-0.6689
EMG	6	14	-0.8260

Table 13

Control Group Report of the Analysis of the Effect of Demerol and Largon from Phase I to Phase II

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	2	18	-0.5040
DBP	2	18	-0.7559
P	2	18	-1.1339
R	2	18	-1.0083
EMG	2	18	-1.0079

Table 14

Control Group Report of the Analysis of the Effect of Demerol and Largon from Phase II to Phase III

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	2	18	-0.7623
DBP	2	18	-0.9576
P	2	18	-0.7620
R	2	18	-0.8941
EMG	2	18	-0.2554

Table 15

Experimental Group Report of the Analysis of the Effect of Demerol and Largon from Phase II to Phase III

Criterion Measure	Number of Subjects Receiving	Number of Subjects Not Receiving	Z Score
SBP	6	14	-0.1652
DBP	6	14	-1.4042
P	6	14	-1.1181
R	6	14	-0.6689
EMG	6	14	-0.8260

Findings and Discussion

Data were analyzed using ten statistical hypotheses. All hypothesis were tested by the t-test and analysis of variance (ANOVA). The t-test were run first and the ANOVA was then run to compare the results. The findings from both test were the same and results of the t-test are presented in this section. Following the statement of each hypothesis is an acknowledgement of acceptance or rejection of the hypothesis, a report of findings which supports the decision, a discussion of these findings, and a discussion of the application of the findings in nursing practice. All hypotheses were tested at the $\alpha = 0.05$ level.

I. There is no statistically significant difference in the baseline criterion measures of the experimental and control groups:

A. SBP
B. DBP
C. P
D. R
E. EMG

There were no significant differences in the baseline criterion measures although the average DBP readings for the experimental group were 5.8 mm of mercury lower than readings for the control group ($\alpha = 0.051$). Therefore statistical hypothesis I was retained. Table 16 contains a report of the analysis of data for between groups baseline recordings. Since the random assignment schedule was followed there is no explanation for the arithmatic differences in baseline data based on the manner of group assignment.

II. There is no statistically significant difference in the baseline to P I criterion measures for the control group:

A. SBP
B. DBP
C. P
D. R
E. EMG

Criterion measures for control subjects did not change significantly from baseline to P I. Therefore, hypothesis II was retained as stated. The report of the analysis of data for hypothesis II appears in Table 17. Interestingly, the R for control subjects decreased from baseline to P I and the level of significance of 0.051 approached the selected level of 0.05. The

Table 16

Report of Analysis of Baseline Criterion Measures
for Experimental and Control Subjects

Criterion Measure	Group	Number of Cases	Mean	Standard Deviation	Standard Error	Pooled t value	df
SBP	C	18	116	12.686	2.990		
	E	16	108	9.661	2.415	1.62	32
DBP	C	18	68	8.815	2.078		
	E	16	62	7.890	1.972	*2.03	32
P	C	18	82	17.421	4.106		
	E	16	85	11.841	2.960	-0.67	32
R	C	18	21	5.821	1.372		
	E	16	19	4.817	1.204	0.99	32
EMG	C	18	3.1	2.135	0.503		
	E	16	4.0	2.193	0.548	-1.17	32

*$\alpha = 0.051$

Table 17

Report of Analysis of the Control Group's Criterion Measures from Baseline to Phase I

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	B	17	116	2.0641	7.158	1.736	1.19	16
	P I		114					
DBP	B	17	68	0.8600	5.491	1.332	0.65	16
	P I		66					
P	B	17	80	1.5412	8.958	2.173	0.71	16
	P I		78					
R	B	17	21	2.3424	4.575	1.109	*2.11	16
	P I		19					
EMG	B	17	3.0	-0.1135	1.762	0.427	-0.27	16
	P I		3.2					

*α = 0.051

presence of the researcher may have resulted in control clients feeling more at ease and therefore having a lower R.

In addition to the control group's baseline to P I comparison, analysis of the baseline to P II and baseline to P III criterion measures was also performed. The findings from these test showed the control group's P to be significantly lower from baseline to P III. There were no other criterion measures that showed a statistically significant difference from baseline to P II or baseline to P III. The report of the baseline to P II analysis appears in Table 18 while that of the baseline to PIII analysis is in Table 19.

III. There is no statistically significant difference in the P I to P II criterion measures for the control group:

A. SBP
B. DBP
C. P
D. R
E. EMG

Although all measures increased from P I to P II the control group's criterion measures showed no statistically significant difference. Consequently, hypothesis III was retained as stated. The report for the analysis of data for hypothesis III appears in Table 20. The arithmetic increase in criterion measures suggests that the physiological stress of labor overrides the influence of medication administered to the subjects as well as the presence of the researcher.

Table 18

Report of Analysis of the Control Group's Criterion Measures from Baseline to Phase II

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	B	13	116	1.4415	13.060	2.124	0.68	12
	P II		114		8.935			
DBP	B	13	68	1.0654	9.416	2.217	0.48	12
	P II		66		9.434			
P	B	13	84	5.2669	13.708	2.473	2.13	12
	P II		80		14.055			
R	B	13	21	0.5862	5.974	1.516	0.39	12
	P II		21		5.570			
EMG	B	13	3.4	0.0392	2.341	0.656	0.06	12
	P II		3.3		1.504			

Table 19

Report of Analysis of the Control Group's Criterion Measures from Baseline to III

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	B	9	116	-0.911	15.125	3.548	-0.28	8
	P III		118		9.034			
DBP	B	9	68	-2.0467	10.296	4.045	0.51	8
	P III		66		10.019			
P	B	9	84	9.7778	15.677	3.274	2.99*	8
	P III		74		10.414			
R	B	9	21	-1.5067	5.292	1.293	-1.17	8
	P II		23		4.675			
EMG	B	9	3.9	1.068	2.366	1.068	0.00	8
	P II		3.3		2.087			

*α = .05

Table 20

Report of Analysis of the Control Group's Criterion Measures from Phase I to Phase II

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	P I	13	114	0.0638	4.524	1.255	0.05	12
	P II		114					
DBP	P I	13	68	1.6554	6.452	1.790	0.93	12
	P II		66					
P	P I	13	78	0.8862	5.789	1.605	0.55	12
	P II		78					
R	P I	13	19	-2.1877	4.475	1.241	-1.76	12
	P II		21					
EMG	P I	13	3.1	-0.2962	1.575	0.437	-0.68	12
	P II		3.4					

IV. There is no statistically significant difference in the P II to P III criterion measures for control group:

A. SBP
B. DBP
C. P
D. R
E. EMG

All control group criterion measures except P increased from P II to P III; however, there was no statistically significant difference between phases. Hence, hypothesis IV was retained. A report of the analysis of data for the control group's P II and P III comparison appears in Table 21.

There was no apparent reason that the P for control subjects decreased from P II to P III while all other measures increased. The presence of the researcher did not prevent the rise in SBP, DBP, R, and EMG. The nurse working with clients in labor and delivery may be reassured to know that women who have minimal preparation for childbirth have stable measures for SBP, DBP, P, R, and EMG and that these measures may rise during labor but these measures fall within normal limits.

V. There is no statistically significant difference in the baseline to P I criterion measures for the experimental group:

A. SBP
B. DBP
C. P
D. R
E. EMG

All measures for the experimental group increased from baseline to P I except EMG; however, the change was not statistically

Table 21

Report of Analysis of the Control Group's Criterion Measures from Phase II to III

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	P I P II	11	118 120	-2.1473	6.408	1.932	-1.11	10
DBP	P I P II	11	68 68	-0.1736	6.097	1.838	-0.09	10
P	P I P II	11	76 74	-1.7082	5.363	1.617	-1.06	10
R	P I P II	11	20 24	-3.3773	3.761	1.134	-2.98	10
EMG	P I P II	11	3.1 4.0	-0.8909	2.309	0.696	-1.28	10

significant. Accordingly, hypothesis V was retained as stated. A report of the analysis of data for the experimental group's baseline to P I comparison appears in Table 22.

The baseline recordings for SBP, DBP, and R were lower than the average for the combined control and experimental groups; however, the P and EMG scores were higher than the average for the combined groups. A possible explanation for the higher EMG scores in the experimental group at baseline may be the knowledge that they would receive audio biofeedback. The subject's knowledge that she would be receiving audio biofeedback at the initial connection may have resulted in tensing the frontalis. The baseline measure was taken prior to the audio biofeedback session. Further explanation may be that P may have been up to insure adequate oxygenation in response to the relatively low SBP and DBP in experimental subjects.

In addition to the baseline to P I comparison, analysis of the experimental group's baseline to P II and baseline P III criterion measures was also performed. The findings from these tests showed the experimental group's SBP from baseline to P III to be statistically significant. The P III measure was higher than the baseline reading. There were no other criterion measures that showed a statistically significant difference from baseline to P II or baseline to P III. The report of the baseline to P II analysis appears in Table 23 while that of the baseline to P III analysis is in Table 24.

Table 22

Report of Analysis of the Experimental Group's Criterion Measures from Baseline to Phase I

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	B	9	110	-2.2700	10.288	3.429	-0.66	8
	P I		112					
DBP	B	9	62	-0.5211	4.854	1.618	-0.32	8
	P I		64					
P	B	9	88	1.4756	4.774	1.591	0.93	8
	P I		86					
R	B	9	21	-0.5367	3.6919	1.206	-0.44	8
	P I		21					
EMG	B	9	4.4	0.9611	1.628	0.543	1.77	8
	P I	9	3.5					

Table 23

Report of Analysis of the Experimental Group's Criterion Measures from Baseline to Phase II

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	B	10	112	-1.7220	10.741	2.597	-0.66	9
	P II		114		10.865			
DBP	B	10	64	-2.0960	6.114	2.169	-0.97	9
	P II		66		7.970			
P	B	9	88	2.2667	10.285	3.915	0.58	8
	P II		86		10.984			
R	B	9	19	-1.0967	4.899	1.615	-0.68	8
	P II		20		3.516			
EMG	B	10	4.0	1.3530	2.539	0.645	2.10	9
	P II		2.6		1.217			

Table 24

Report of Analysis of the Experimental Group's Criterion Measures from Baseline to Phase III

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	B	8	108	-13.5412	7.309	3.600	-3.76**	7
	P III		122		16.450			
DBP	B	8	60	-10.4575	8.311	1.597	-6.55**	7
	P III		70		10.403			
P	B	7	88	1.5486	9.641	5.280	0.29	6
	P III		86		15.255			
R	B	7	17	-3.5000	4.276	2.440	-1.43	6
	P III		20		6.214			
EMG	B	8	3.0	0.4637	1.681	0.878	0.53	7
	P III		2.6		1.807			

**α = < .01

VI. There is no statistically significant difference in the P I and P II criterion measures for the experimental group:

A. SBP
B. DBP
C. P
D. R
E. EMG

In experimental subjects both SBP and DBP increased from P I to P II while P, R, and EMG decreased; yet, the changes were not statistically significant. Therefore, hypothesis VI was retained as stated. A report of the analysis of data for the experimental group's P I and P II comparison appears in Table 25.

The EMG decreased from P I to P II and may have been the result of the clients increasing confidence in using the audio biofeedback. This arithmetic trend in the data suggests that the experimental subjects were able to reduce frontalis muscle tension and offers tangible evidence to the nurse working with minimally prepared clients that these clients are able to learn and to maintain some measure of control over a bodily function during labor.

VII. There is no statistically significant difference in the P II to P III criterion measures for the experimental group:

A. SBP
B. DBP
C. P
D. R
E. EMG

From P II and P III the experimental group's criterion measures of SBP, DBP, and R increased, P remained approximately the

Table 25

Report of Analysis of the Experimental Group's Criterion Measures from Phase I to Phase II

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	P I	8	114	-1.6650	8.088	2.859	-0.58	7
	P II		116					
DBP	P I	8	68	-1.5450	7.249	2.563	-0.60	7
	P II		68					
P	P I	8	85	-0.8187	7.138	2.524	-0.32	7
	P II		86					
R	P I	8	20	-1.4438	5.350	1.891	-0.76	7
	P II		21					
EMG	P I	8	3.3	0.8862	2.024	0.716	1.24	7
	P II		2.4					

same and EMG decreased. The P II to P III criterion measure of SBP showed a difference of 0.031 which was significant. However, since the other four criterion measures did not show significant changes, hypothesis VII was retained. In order to clearly reject the hypothesis, all measures would need to be stated individually. The results of the analysis of data for the experimental group's P II to P III comparison appears in Table 26.

The arithmetic decrease in the EMG in P III score indicates that experimental subjects were able to lower the muscle tension although not to a significant degree from P II. This arithmetic trend in the data suggests that clinically these clients were able to control the tension of the frontalis muscle in the presence of the physiological stress of P III.

VIII. There is no statistically significant difference in the P I criterion measures for the experimental and control groups:

A. SBP
B DBP
C. P
D. R
E. EMG

The between group comparisons at P I showed no statistically significant differences. Therefore, hypothesis VIII was retained. Data for the between group comparisons for P I is reported in Table 27. The only experimental group criterion measure to decrease from baseline to P I was EMG which may be an indication that the subjects were gaining skill at controlling the measure at will.

Table 26

Report of Analysis of the Experimental Group's Criterion Measures from Phase II to Phase III

Criterion Measure	Phase	Number of Cases	Mean	Difference Mean	Standard Deviation	Standard Error	t value	df
SBP	P II P III	8	120 128	-7.8050	8.211	*2.903	-2.69	7
DBP	P II P III	8	70 74	-3.9438	7.475	2.643	-1.49	7
P	P II P III	7	81 81	0.3443	10.069	3.806	0.09	6
R	P II P III	6	19 20	-0.8600	8.330	3.401	-0.25	5
EMG		8	2.3 2.1	0.1650	1.451	0.513	0.32	7

* $\alpha = 0.031$

Table 27

Report of Analysis of Phase I Criterion Measures
for Control and Experimental Subjects

Criterion Measure	Group	Number of Cases	Mean	Standard Deviation	Standard Error	Pooled t value	df
SBP	C	18	114	8.370	1.973		
	E	11	114	10.217	3.081	0.29	27
DBP	C	18	66	7.987	1.883		
	E	11	66	9.647	2.909	0.25	27
P	C	18	78	11.120	2.621		
	E	11	85	11.367	3.427	-1.66	27
R	C	18	19	3.444	0.812		
	E	11	21	4.724	1.424	-1.29	27
EMG	C	18	3.1	1.459	0.344		
	E	11	3.1	2.099	0.633	-0.11	27

Five graphs (Figures 1 through 5) show the comparison of criterion measures for the control and experimental group across baseline to P III. All criterion measures fall within a normal range and the graphs were designed to represent pictorially the results of the between group comparisons. These graphs reflect the differences between groups and apply to hypotheses I, VIII, IX, and X.

IX. There is no statistically significant difference in the P II criterion measures for the experimental and control groups:

A. SBP
B. DBP
C. P
D. R
E. EMG

For P II the between group criterion measures showed no statistically significant difference. Therefore, hypothesis IX was retained. Data for P II comparison appears in Table 28.

During P II the criterion measures of SBP and DBP for both groups increased while control subjects P, R, and EMG increased and experimental subjects P, R, and EMG decreased. The continuing decrease in the experimental subjects EMG suggests that with added practice these subjects were gaining greater control of the muscle. Clinically, the trend of lowering EMG for experimental subjects as compared to control subjects offers clinical evidence that minimally prepared women can respond to instruction initiated during hospitalization for labor and delivery.

Figure 1

Comparison of control and experimental groups' systolic blood pressure by phases

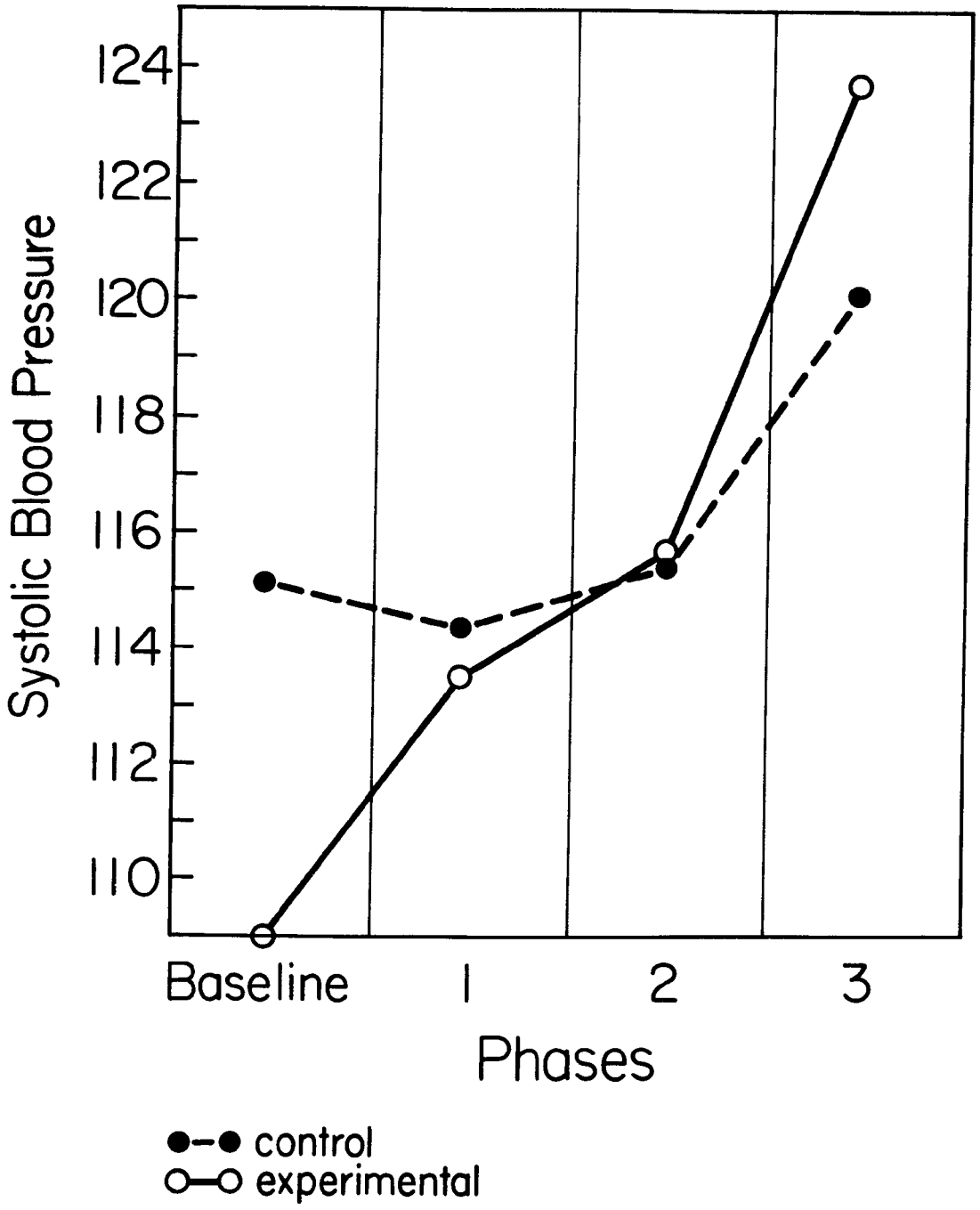

Figure 2

Comparison of control and experimental groups' diastolic blood pressure by phases

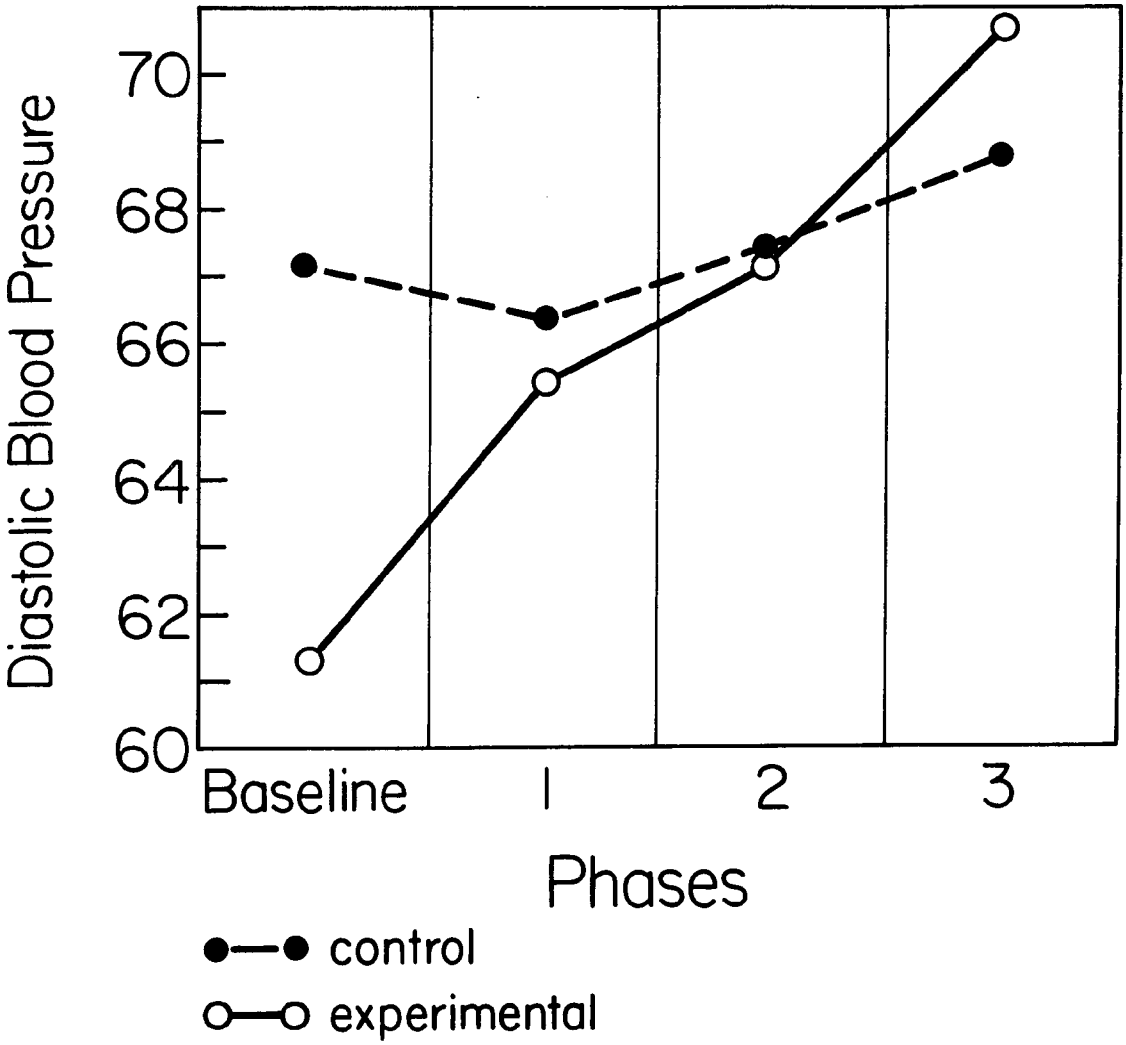

Figure 3

Comparison of control and experimental groups' pulse by phases

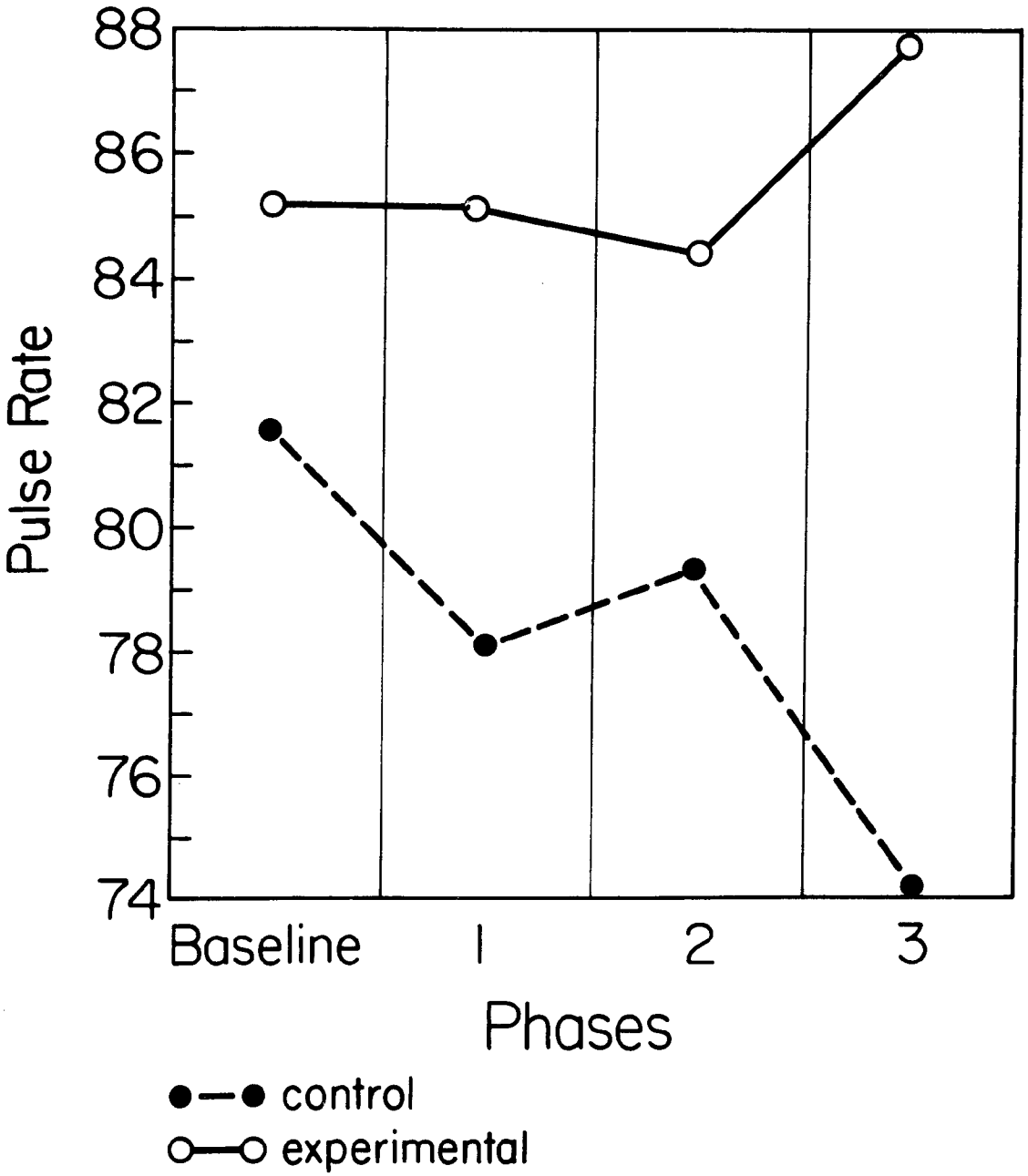

Figure 4

Comparison of control and experimental groups' respiratory rate by phases

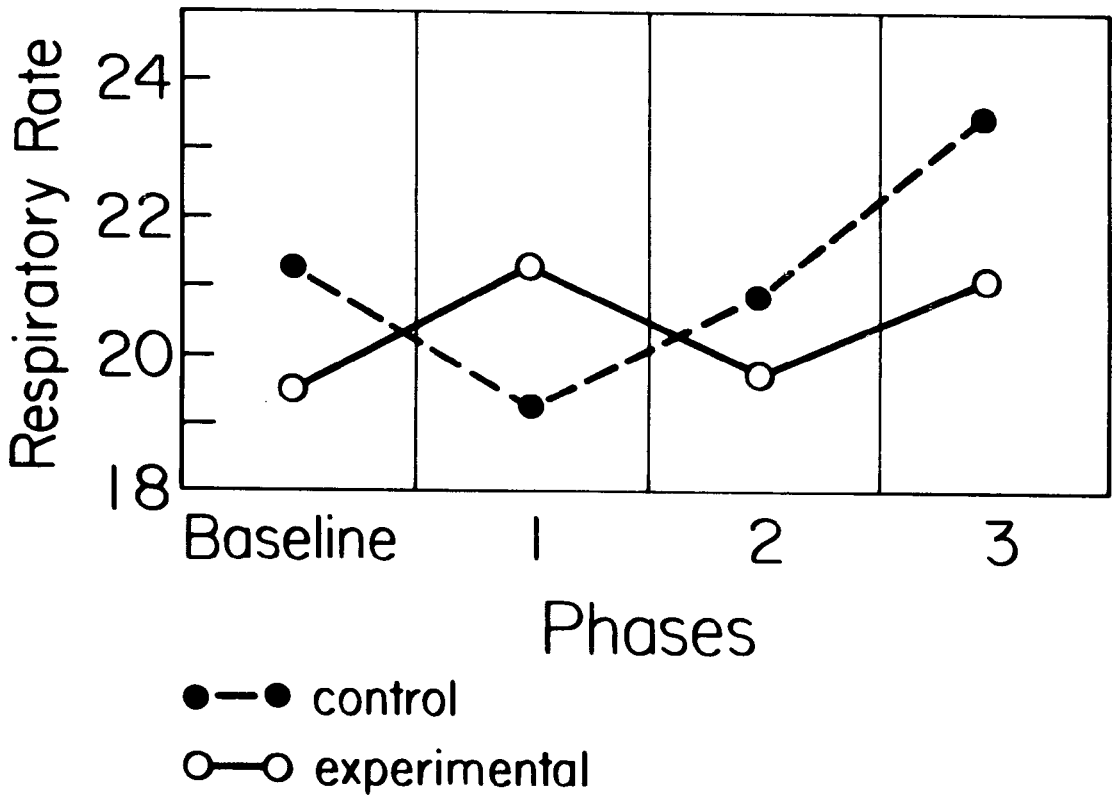

Figure 5

Comparison of control and experimental groups' EMG score by phases

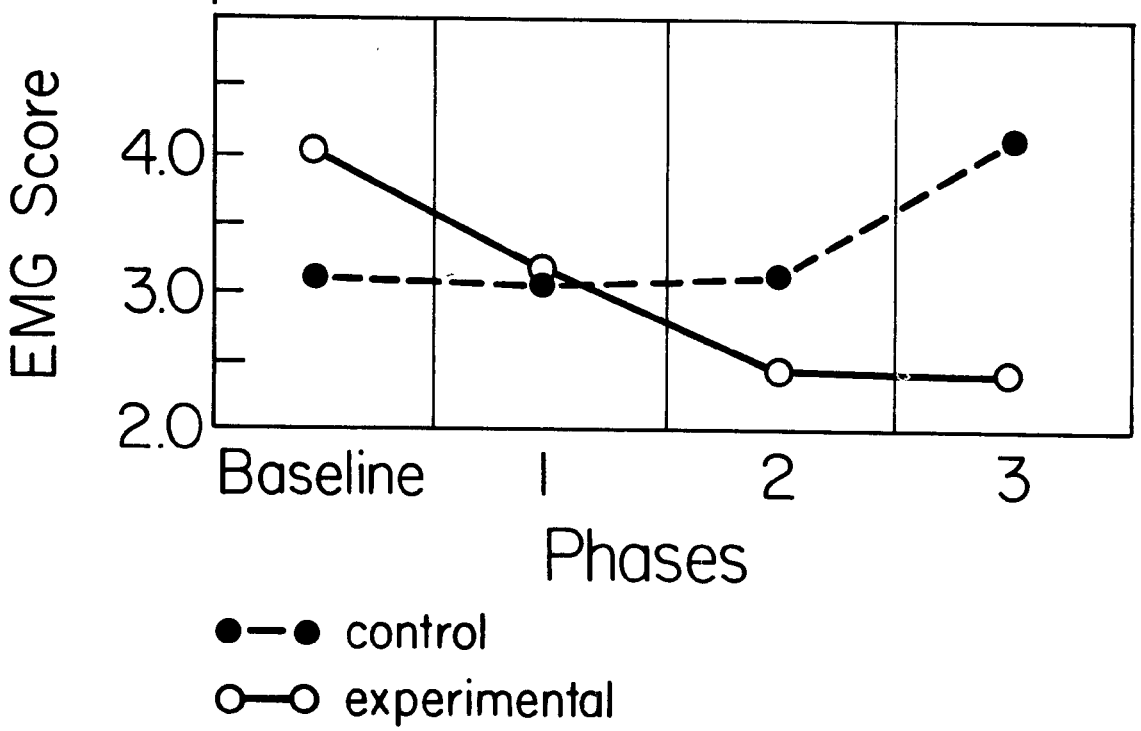

Table 28

Report of Analysis of Phase II Criterion Measures
for Control and Experimental Subjects

Criterion Measure	Group	Number of Cases	Mean	Standard Deviation	Standard Error	Pooled t value	df
SBP	C	15	116	9.483	2.448		
	E	13	116	10.894	3.022	-0.00	26
DBP	C	15	68	9.375	2.421		
	E	13	68	10.637	2.950	0.04	26
P	C	15	79	13.037	3.366		
	E	12	85	11.728	3.386	-1.07	25
R	C	15	21	5.261	1.358		
	E	12	20	3.456	0.998	0.59	25
EMG	C	15	3.2	1.450	0.374		
	E	13	2.4	1.172	0.325	1.63	26

X. There is no statistically significant difference in the P III criterion measures for the experimental and control groups:

A. SBP
B. DBP
C. P
D. R
E. EMG

The analysis of data for P II between group comparisons revealed a statistically significant difference ($\alpha = 0.48$) in P with control subjects showing lower scores. However, all other criterion measures showed no difference. Therefore, hypothesis X was retained. In order for the hypothesis to be clearly rejected, all criterion measures would need to be stated individually. The report of the analysis of data for the P III comparison appears in Table 29.

The EMG criterion measure comparison was $\alpha = 0.057$ with experimental subjects having lower scores than control subjects. Although this measure did not reach the selected 0.05 level, the measure closely approached being statistically significant. The control group's EMG level increased from P II to P III while the experimental groups EMG level remained approximately the same from P II to P III. Again, arithmetically the experimental subjects showed an ability to control the tension of the frontalis muscle.

Table 29

Report of Analysis of Phase III Criterion Measures
for Control and Experimental Subjects

Criterion Measure	Group	Number of Cases	Mean	Standard Deviation	Standard Error	Pooled t value	df
SBP	C	11	120	10.383	3.313		
	E	12	124	14.146	4.084	-0.70	21
DBP	C	11	68	11.556	3.484		
	E	12	70	10.039	2.898	-0.60	21
P	C	11	74	9.572	2.886		
	E	11	88	19.582	5.904	*-2.10	20
R	C	11	23	4.472	1.348		
	E	10	21	5.492	1.737	1.05	19
EMG	C	11	4.0	2.260	0.681		
	E	12	2.4	1.579	0.456	**2.01	21

*α = 0.048
**α = 0.057

CHAPTER V

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Introduction

The final chapter of this dissertation contains a summary of findings, conclusions, a discussion of findings from this study and other related studies, and recommendations for further study. The discussion of findings includes mention of ways that future research with biofeedback might be enhanced. Finally, recommendations are included which have implications for further nursing research with women in labor and biofeedback.

Summary

When the design was prepared for this project, the study nurse anticipated that experimental participants would show lower increases than control subjects for all measures from baseline to P III. The analysis of data for this study using audio biofeedback as a nursing intervention for minimally prepared women in labor does not support the study hypothesis. Experimental group data analysis showed an arithmetic trend of increases in SBP, DBP, and P, minimal variation in R, and a decrease in the EMG score which suggest that clinically women may be able to use audio biofeedback to reduce the frontalis muscle tension during P I, P II, and P III

of labor. However, the arithmetic trend in data suggests that additional study is necessary to provide an understanding of the meaning of the study results and to produce homologous results in similar settings and with women who have other types of preparation for labor.

Both the SBP (Figure 1) and DBP (Figure 2) recordings from the experimental and control groups showed an upward trend across P I through P III although the experimental group had a higher rise in SBP and DBP than did the control group. Across the phases the P of the control group declined while that of the experimental group remained approximately the same until P III when a rise occurred (Figure 3). The SBP and DBP measures for control subjects were higher than the experimental subjects at baseline and may account for the control groups' lower rise in these measures.

In the comparisons between the phases in the control and experimental groups, one SBP criterion measure showed a difference below $\alpha = 0.05$. This difference appeared in the SBP measure between P II and P III for the experimental group. The actual α level for this statement was 0.031 (Table 26). The experimental group's SBP increased significantly from P II to P III. The t-test between group comparison of DBP was near the $\alpha = 0.05$ level of significance. The between groups baseline DBP had an actual α level of 0.051. In this instance the experimental group had a lower mean score than the control group.

The R of all subjects showed the least consistent variation of all the criterion measures across phases. The control group had a

decline in R from baseline to P I and a steady increase from P I through P III (Figure 4). Experimental participants had an increase in R from baseline to P I, a decrease from P I to P II, and an increase from P II to P III. The Demerol and Largon combination generally causes R depression, but the control group actually had an increase in R. This variability of R may indicate either minimal or reverse influence of the medication on R and perhaps the lack of response of the respiratory rate to the study intervention. A measure that approached the 0.05 level of significance was between the control group's baseline and P I R. The actual α level was 0.051 for this comparison (Table 17). The control group's R decreased from the baseline to P I.

A most interesting difference among the criterion measures occurred in the P III EMG scores. The control group had relatively stable scores from baseline to P II and from P III. Between P II and P III the control group's EMG readings increased from 3.2 μV to 4.07 μV (Figure 5). The EMG readings for the experimental participants decreased from baseline to P I and from P I to P II and remained stable from P II to P III. The P III EMG mean score for the experimental group was 2.44 μV. The t-test showed the α level to be 0.057 for the EMG score between control and experimental participants in P III with the experimental group's recordings being lower. Clinically, this finding infers that the experimental participants were able to use the audio biofeedback to decrease their frontalis EMG scores during labor although not at the adopted level of significance for this study. In P III there were

11 control participants and 12 experimental participants. If there had been a higher number of recordings for participants in this phase the difference might have reached the established level.

Conclusions

The findings from this study supported the conclusion that no statistically significant difference existed in the SBP, DBP, P, R, and EMG for women who used continuous audio biofeedback and women who did not use continuous audio biofeedback during labor.

Although all the criterion measures did not change in the same direction for control participants and experimental participants, the changes that did occur are indeed intriguing. The control group had arithmetic increases in SBP, DBP, R, and EMG and a decrease in P which may imply that the forces in their body were not in concert. Experimental participants evidenced an arithmetic increase in SBP, DBP, P, a slightly increasing R, and decreasing EMG. These arithmetic trends for experimental subjects may suggest that the frontalis muscle was more relaxed and other physiological response systems were more responsive to the stressors associated with labor. However, due to the floor effect, the criterion measures selected for this study may not fluctuate enough within the normal range during labor for these measures to be a good indicator of the body's response to labor.

Additionally, the experimental subjects may have spent more time in the AR stage of the GAS as they adapted to the stressors associated with labor. Furthermore, the arithmetic increases in

the experimental subjects' criterion measures may suggest that during each phase of labor the women entered the AR stage of the GAS. As the number and intensity of stressors increased during labor each subject had to adapt to the greater amount of stress. Perhaps because of the experimental subjects' lower EMG scores, these women may have been able to respond more readily by entering the AR stage of the GAS.

Discussion

Naliboff and Johnson (1978) pointed out that studies are needed to demonstrate that relationships among variables are not situation or task-specific before a clear picture will emerge of biological constraints or general physiological dimensions of responding to stress. Although there have been numerous studies reporting the use of EMG biofeedback assisted relaxation, the review of the literature showed that future researchers need to develop some consistency in obtaining data on comparable measures. Criterion measures used in simulated clinical settings and actual clinical trials need to be more standard so the data can be compared. If such data were available, differences in response to induced physiological and psychological stress and various clinical physiological and psychological stress may become apparent. Such data might be helpful to nurses in screening to detect those who are not responding within normal limits.

Meichenbaum (1976) stated that biofeedback training includes three phases: initial conceptualization, skills-acquisition and

rehearsal and transfer of treatment. Since the women in labor were allowed to use the feedback continuously from the introductory session throughout the period of data collection, there was no transfer of treatment involved. A cognitive factor was involved in the research on women in labor since both groups were instructed to "let their body be limp" throughout labor during initial instruction.

McGowan et al. (1979) studied the effect of one session of frontal EMG feedback on frontal EMG, frontal EMG response to stress, cardiovascular variables and cardiovascular response to stress. Heart rate, pulse blood-volume, and finger temperature were the cardiovascular measures included in the study. The authors involved eighteen male and female undergraduate students in either frontalis EMG feedback or relaxation instructions and then exposed them to a fear stimulus (visualization) and a post stress adaptation period. The students receiving frontal EMG feedback significantly reduced resting levels of frontal EMG and frontal EMG response to stress but showed no significant result in cardiovascular measures. These authors concluded that the single EMG session may attenuate the response to stress but may be confined to the specific muscle groups monitored. When evidence from the above mentioned study is compared to that with minimally prepared women in labor, some dichotomy becomes apparent.

In this study on women in labor, the EMG feedback group had increases in all criterion measures except EMG. These increases did not reach the 0.05 level of significance for all measures

between phases or in comparison to the recordings for the control group. However, due to the variation in P some type of cardiovascular response may have been occurring differently in the experimental group than that in the control group. McGowan et al. used a psychological stress while the experiences and process of childbirth produces psychological and physiological stress. The types of stressors are different and may produce a dissimilar cardiovascular response. An apparent question is what effect on cardiovascular response is there from introduction of a fear stimulus, a fear stimulus and a pain stimulus, versus a pain stimulus on control women, women using EMG feedback and women using relaxation? Also, the women in labor are exposed to increasing intermittent stress over time. Students in the McGowan et al. study were exposed to a one-time fear stimulus. A second question raised is does increasing intermittent physiological stress such as labor over time produce results different from exposure to a one-time fear stimulus?

The process of labor results in physiological as well as psychological responses in the woman. Adaptive mechanisms may be inherent in the physiological and psychological changes that occur during pregnancy and labor which protect the woman against abnormal fluctuations in SBP, DBP, P, and R during labor. The intermittent nature of the contractions as well as the gradually increasing intensity of the contractions may be a part of an adaptive mechanism which primes the body for delivery and thus maintain the level of vital functioning within normal limits.

Frazier (1974) reported the use of multimodal biofeedback during labor. Perhaps using audio biofeedback from another muscle group, skin temperature, or using the GSR would produce different results in minimally prepared women. Also, Kerr (1977) discussed the influence of an increase in sympathetic activity on GSR and skin temperature and indicates that these parameters may be viable measures of an individuals response to stress. Moreover, Benson, Dryer and Hartley (1978) reported that oxygen consumption decreased in exercise with the elicitation of the relaxation response.

In a study on recovery from surgery, Johnson, Rice, Fuller, and Endress (1978) compared the use of experimental tape recordings of instructions regarding coping activities (nine minute tape with a book of illustrated photographs), description of events and procedures (six and one-half minute) and description of sensations (7 minute) versus controls receiving no experimental information or instructions. The descriptions of sensations significantly reduced the length of postoperative hospitalization and the length of time after discharge that patients ventured from their home. Also, the instructions were found to dampen negative moods postoperatively.

Recommendations

Due to the arithmetic trend of experimental subjects' decreasing EMG score and the discussion of criterion measures and other measures reflecting response to stress, the following recommendations are offered. Additional studies be conducted in order to identify which measures reflect the response of the woman's body

to the stressors associated with labor by recording throughout labor information on the criterion measures, oxygen consumption, GSR, skin temperature, and EMG from several muscle sites for:

1. minimally prepared women in labor who are using EMG audio biofeedback.
2. prepared women in labor who are introduced to EMG audio biofeedback upon entering the labor unit.
3. women who are introduced to EMG audio biofeedback in preparation for labor classes.
4. minimally prepared women.
5. women who listen to experimental tape recordings regarding coping activities, description of events and procedures, and description of sensations with and without continuous audio biofeedback.

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APPENDICES

Appendix A

Institutional Consent Form

1111 Columbiana Road
Apartment 3
Birmingham, Alabama 35209

Director of Nursing Service

_____

_____

Dear Director:

I am a student at the University of Alabama School of Nursing, University of Alabama in Birmingham. Part of the requirements for the degree of Doctor of Science in Nursing is planning, conducting, and reporting research which contributes to the knowledge base for nursing. The dissertation research that I would like to conduct involves the use of audio biofeedback as a nursing intervention during labor.

The purpose of the research is to determine the effectiveness of the nursing intervention of continuous audio biofeedback as a means of assisting women, who have minimal prenatal preparation, to deal with labor. Enclosed is a copy of the research design for your review. The following text provides a synopsis of the proposed study.

The proposed research is experimental in nature and will involve 40 women who will be divided into two groups. One group will be a control group and these women will be monitored for criterion measures throughout labor. A second group will be introduced to biofeedback during early labor. Women in the experimental group will use audio biofeedback throughout labor to assist them in coping with labor. In addition, these women will be monitored for criterion measures throughout labor.

Criterion measures selected for the study include physiologic parameters which are muscle stress, pulse, respiratory rate, and blood pressure. All parameters except muscle stress are usually monitored throughout labor. The study nurse will do the biofeedback session and collect data required for the study. At no time will the study nurse replace staff nurses assigned to the laboring woman.

Biofeedback will be accomplished using the J 33 Cyborg unit which emits a tone indicating the degree of stress and which provides a muscle tension score. Disks will be attached to the frontalis

muscle of the laboring woman. Research has shown this muscle to be a good indicator of the degree of tension in the body. The researcher will conduct the biofeedback session and monitor physiologic parameters every 15 minutes throughout labor.

The researcher will assume all responsibility for cost related to the proposed study. Neither the hospital nor the woman in labor will be expected to incur any cost related to the study.

Physicians who admit obstetrical patients at _____ _____ hospital will be sent a letter to obtain consent for their patients to participate in the proposed research. In addition, the woman will be asked to sign a written consent to participate in the study. If at any time the study interfers with the patient's well being, data collection will be suspended. Also, data will be recorded as grouped data. At no time will study participants be identified. In written reports, the institution where data is collected will not be identified.

The research is designed to test the effectiveness of introducing audio biofeedback during labor to assist women who are minimally prepared for labor. Using audio biofeedback throughout labor will give the woman immediate feedback on the degree of stress in her body.

If you have any questions regarding the proposed study, please contact me, Sylvia Britt, by phone at 934-4402 or 942-1222. I would like permission to begin data collection on _____ and to continue data collection through _____ or until data on 40 subjects has been collected. If you agree to allow data collection for the proposed study, please complete the blank at the bottom of this page and return the original to me in the enclosed self-addressed envelope.

Sincerely

Sylvia Squires Britt, R.N., B.S.N., M.S.N.
Doctoral Student

I understand that signing this letter grants permission for Sylvia Britt to conduct a study on biofeedback in labor in this hospital. Permission extends from _____ through _____ or until 40 women have participated in the study.

_____ _____

DATE DIRECTOR OF NURSING SERVICE

_____

WITNESS

Appendix B

Physician Consent Form

1111 Columbiana Road
Apartment 3
Birmingham, Alabama 35209

Practicing Obstetrician

_____

_____

Dear Doctor _____:

I am a student at the University of Alabama School of Nursing, University of Alabama in Birmingham. Part of the requirements for the degree of Doctor of Science in Nursing is planning, conducting, and reporting research which contributes to the knowledge base for nursing. The dissertation research that I would like to conduct involves the use of audio biofeedback as a nursing intervention during labor.

The purpose of the research is to determine the effectiveness of the nursing intervention of continuous audio biofeedback as a means of assisting women, who have minimal prenatal preparation, to deal with labor. Enclosed is a copy of the research design for your review. The following text provides a synopsis of the proposed study.

The proposed research is experimental in nature and will involve 40 women who will be divided into two groups. One group will be a control group and these women will be monitored for criterion measures throughout labor. A second group will be introduced to biofeedback during early labor. Women in the experimental group will use audio biofeedback throughout labor to assist them in coping with labor. In addition, these women will be monitored for criterion measures throughout labor.

Criterion measures selected for the study include physiologic parameters which are muscle stress, pulse, respiratory rate, and blood pressure. All parameters except muscle stress are usually monitored throughout labor. The study nurse will do the biofeedback session and collect data required for the study. At no time will the study nurse replace staff nurses assigned to the laboring woman.

Biofeedback will be accomplished using the J 33 Cyborg unit which emits a tone indicating the degree of stress and which provides a muscle tension score. Disks will be attached to the frontalis muscle of the laboring woman. Research has shown this muscle to be

a good indicator of the degree of tension in the body. The researcher will conduct the biofeedback session and monitor physiologic parameters every 15 minutes throughout labor.

The researcher will assume all responsibility for cost related to the proposed study. Neither the hospital nor the woman in labor will be expected to incur any cost related to the study.

The Director of Nursing at _____ _____ hospital will be sent a letter to obtain consent for the hospital to participate in the proposed research. In addition, the woman will be asked to sign a written consent to participate in the study. If at any time the study seems to interfere with the patient's well being, data collection will be suspended. Also, data will be recorded as grouped data. At no time will study participants be identified. In written reports, the institution where data is collected will not be identified.

The research is designed to test the effectiveness of introducing audio biofeedback during labor to assist women who are minimally prepared for labor. Using audio biofeedback throughout labor will give the woman immediate feedback on the degree of stress in her body.

If you have any questions regarding the proposed study, please contact me, Sylvia Britt, by phone at 934-4402 or 942-1222. I would like permission to begin data collection on _____ and to continue data collection through _____ or until data on 40 subjects has been collected. If you agree to allow data collection for the proposed study, please complete the blank at the bottom of this page and return the original to me in the enclosed self-addressed envelope.

Sincerely

Sylvia Squires Britt, R.N., B.S.N., M.S.N.
Doctoral Student

I understand that signing this letter grants permission for Sylvia Britt to conduct a study on biofeedback in labor using my patients. Permission extends from _____ through _____ or until 40 women have participated in the study.

_____ _____
DATE PRACTICING OBSTETRICIAN

_____
WITNESS

Appendix C

Control Group Consent Form

You are being invited to participate in a study on women in labor. The study is aimed at learning better ways of assisting women who have not been able to attend classes about labor. Hopefully, the study of ways to help women in labor will result in improvement in nursing care for women in labor. This study involves the use of a machine to record degree of muscle stress.

A machine disk picks up the stress in your muscles. The amount of stress shows up on a gauge on the machine. The study nurse will record the amount of stress from the machine.

Women who are expecting their first baby who come to this hospital between _____ and _____ will be asked to be in the study. If you decide to be in the study, you will be asked to sign a written consent form which shows that you agree to the study. Next, three disks which are about the size of a penny will be placed on your forehead to record the stress in your muscles.

Every 15 minutes throughout labor the study nurse will record the degree of stress in your forehead. At the same time the study

_____

Initial

nurse will take and record your heart rate, respiratory rate, and blood pressure. All of these measures help to determine the degree of stress in your body.

If at any time you decide to get out of the study, ask the study nurse to leave your bedside. The study nurse will then remove the disks from your forehead and leave your bedside. The nurse employed by the hospital will continue to help you during labor. Your decision to participate or not to participate in the study will in no way affect the care given by the hospital nurses.

The only discomfort you may experience by being in the study may be slight irritation from the disks. The disks are round and will be placed flat against your skin. A small amount of jelly-like paste will be put between your skin and the disks. Three disks will be held in place by a soft rubber strap that fits around your head. Recordings of heart rate, respiratory rate, and blood pressure are usually made throughout labor. Due to your involvement in the study, these signs will be taken more frequently.

There are few risks related to your being in the study. The study nurse wants to get information about the degree of stress in your body during labor. Your participation in the study should not change your labor. There are no costs to you or the hospital related to this study. The final results of the study may be used by nurses to help other women have less stress during labor. The

_____

Initial

University of Alabama has made no provision for monetary compensation to you in the event of physical injury resulting from the research procedure. Should physical injury occur, medical treatment is available, but treatment is not provided free of charge.

When the study is completed, a report will be written in the form of a paper. The paper is necessary for the study nurse to obtain a doctoral degree in nursing. The results of the study may also be submitted to journals for publication so other people will know what the study shows. Your name will not be mentioned in any form in the written reports of the study. The only record the study nurse will have of your name is on a copy of this form. If you agree to participate in the study, you will be given a copy of this form. You may request a short summary of the study results by placing your name and address at the bottom of this form that the study nurse will keep. This form and your records will be kept separate so there will be no way to match you and the recordings. If you have any questions about the study, you may contact the study nurse, Sylvia Britt, by calling 934-4402 or 942-1222. You are making a decision about being in the study. Your signature indicates that you have decided to be in the study based on the

_____

Initial

explanation given by the study nurse and having read this form. Thank you for considering being a study participant.

Sincerely,

Sylvia Squires Britt, R.N., B.S.N., M.S.N.
Doctoral Student

_____	_____
DATE	TIME AM PM
_____	_____
SIGNATURE OF PARTICIPANT	SIGNATURE OF STUDY NURSE

_____

SIGNATURE OF WITNESS

Appendix D

Experimental Group Consent Form

You are being invited to participate in a study on women in labor. The study is aimed at learning better ways of assisting women who have not been able to attend classes about labor. Hopefully, the study of ways to help women in labor will result in improvement in nursing care for women in labor. This study involves the use biofeedback.

Biofeedback gives you information about your body. A machine disk picks up the tension in your muscles. The machine clicks faster when your muscles are tense and slower when you are more at ease.

Women who are expecting their first baby who come to this hospital between _____ and _____ will be asked to be in the study. If you decide to be in the study, you will be asked to sign a written consent form which shows that you agree to be in the study. Next, you will have three disks which are about the size of a penny will be placed on your forehead. You will be given instructions on how to use the biofeedback throughout your labor. You will have an initial instruction session and an hourly review session.

_____

Initial

Once the initial instruction is completed, the study nurse will record the the degree of stress in your forehead using a gauge on the machine which gives you biofeedback. Also, the study nurse will take and record your heart rate, respiratory rate, and blood pressure. In addition, the study nurse will make these recordings every 15 minutes throughout labor. All of these measures help to determine the degree of stress in your body.

If at any time you decide to get out of the study, ask the study nurse to leave your bedside. The study nurse will then remove the disks from your forehead and leave your bedside. The nurse employed by the hospital will continue to help you during labor. Your decision to participate or not to participate in the study will in no way affect the care given by the hospital nurses.

The only discomfort you may experience by being in the study may be slight irritation from the biofeedback disks. The disks are round and will be placed flat against your skin. A small amount of jelly-like paste will be put between your skin and the disks. Three disks will be held in place by a soft rubber strap that fits around your head. Recordings of heart rate, respiratory rate, and blood pressure are usually made throughout labor. Due to your involvement in the study, these signs will be taken more frequently. Also, you will have additional information about the degree of stress in your body from the clicks of the biofeedback machine.

_____

Initial

There are few risks related to your being in the study. The study nurse wants to get information about the degree of stress in your body during labor. Your participation in the study may help you to be more comfortable during labor, but the study nurse cannot guarantee that you will be comfortable. In addition, the final results of the study may be used by nurses to help other women have less stress during labor. There is no cost to you or the hospital related to this study. The University of Alabama has made no provision for monetary compensation to you in the event of physical injury resulting from the research procedure. Should physical injury occur, medical treatment is available, but treatment is not provided free of charge.

When the study is completed, a report will be written in the form of a paper. The paper is necessary for the study nurse to obtain a doctoral degree in nursing. The results of the study may also be submitted to journals for publication so other people will know what the study shows. Your name will not be mentioned in any form in the written reports of the study. The only record the study nurse will have of your name is on a copy of this form. You may request a short summary of the study results by placing your name and address at the bottom of this form that the study nurse will keep. This form and your records will be kept separate so there will be no way to match you and the recordings. If you have any questions about the study, you may contact the study nurse,

_____

Initial

Sylvia Britt, by calling 934-4402 or 942-1222. You are making a decision about being in the study. Your signature indicates that you have decided to be in the study based on the explanation given by the study nurse and having read this form. Thank you for considering being a study participant.

Sincerely,

Sylvia Squires Britt, R.N., B.S.N., M.S.N.
Doctoral Student

_____ _____

DATE TIME AM PM

_____ _____

SIGNATURE OF PARTICIPANT SIGNATURE OF STUDY NURSE

_____

SIGNATURE OF WITNESS

Appendix E

Client Assignment to Groups

1 - C	21 - E
2 - E	22 - E
3 - E	23 - C
4 - C	24 - C
5 - C	25 - E
6 - C	26 - E
7 - C	27 - C
8 - C	28 - E
9 - E	29 - E
10 - E	30 - C
11 - E	31 - E
12 - C	32 - C
13 - E	33 - E
14 - C	34 - C
15 - C	35 - E
16 - E	36 - C
17 - C	37 - E
18 - C	38 - E
19 - C	39 - E
20 - E	40 - C

Appendix F

Data Sheet

Client #_____ E C

EDC____ Age____ Parity_____ Admission date and time_____

Attended childbirth classes Y N Name of class_____ # classes attended_____

Have you had previous teaching about biofeedback Y N If yes, where_____

Weight_____ Race_____

Date/Time

Dilitation

Systolic Blood Pressure

Diastolic Blood Pressure

Pulse

Respiration

EMG Reading

Comments

Medications

Nursing measures employed

Person accompanying particiant

Length of P I_____, P II_____, P III_____ Total_____

Form adapted from Fields, Gay and Gilbert, Note 2

Appendix G

Procedure for Application of Sensors*

1. Clean the overall skin area with alcohol.

2. Check to see that disks are clean.

3. Apply adhesive ring to each disk, being sure not to remove the paper-backing.

4. Fill each disk with electrode jelly, and level off the jelly flush with the edge of the cup.

5. Clean the skin for the first disk, being sure to clean only an area big enough for the disk.

6. Remove the paper-backing from the adhesive ring, and apply the disk.

7. Repeat steps 5 and 6 for the second and the ground disk.

8. Once the disks are in place, attach the headband to secure the disks more firmly. Ask the woman to assist with the application of the headband so it is not too tight.

*Procedure adapted from Cyborg manual.

Appendix H

Instructions for Audio Biofeedback

1. Studies show that low stress during labor is beneficial for mother and baby. Other studies show that biofeedback helps people learn to reduce stress. This session is designed to help you learn to reduce stress using biofeedback. You will be using the audio biofeedback monitor throughout labor to help you have less stress.

2. Lie quietly in a comfortable position. Listen only to the sound from the biofeedback machine. This sound indicates the degree of stress of the muscles in your forehead. Rapid clicking indicates greater stress and the slower clicking less stress. Think about making the machine click slowly.

3. To get an idea of the difference in the sounds, tightly wrinkle your forehead and listen to the clicking.

4. Now, close your eyes and relax the muscles of your forehead. Notice the difference in the rate of clicking.

5. During the next 10 minutes keep the monitor making the slow clicking sounds. Also, let your body be limp all over. Do

not worry if occasionally the clicks get faster but do try to return to slow clicking as quickly as possible. An especially important time for you to keep the clicks slow is during contractions or pains. You will be told when 10 minutes is up. Do you have any questions before you practice for 10 minutes? You will not be left alone during practice or during your labor, but everyone will be quiet.

6. Time 10 minutes.

7. The 10 minutes for listening to the machine is up. Lie quietly for a few minutes while the study nurse measures your blood pressure, pulse, respiration, and muscle score. When she is finished, the session is completed. If you begin to tighten up during labor, return to listening to the machine and try to make the machine click slowly by relaxing the muscles in your forehead and letting your body be limp.

Appendix I

Follow Up Biofeedback Session

1. It has been one hour since your last biofeedback session.

2. Can you hear the biofeedback clicking clearly?

3. You are maintaining your muscle stress level at _____.

4. During contractions your muscle stress is at _____.

5. The present level of _____ for your muscle stress is (lower than, higher than, or at the same level) as when you started using the biofeedback.

Appendix J

Control Participants Procedure Guide

During data collection the researcher will:

1. identify a potential participant
2. approach the potential participant
3. identify self
4. explain the study
5. verify that the woman meets study criteria
6. show the woman the consent form
7. explain the purpose of the consent form
8. read aloud the consent while the woman reads silently
9. invite questions about the study
10. allow the woman five minutes alone to consider the study and while outside room,

    A. check batteries in the EMG machine
    B. remove speaker wires from the EMG machine
    C. prepare EMG disks for use)

11. return to room and invite questions
12. ask for woman's decison
13. supply copies of consent for signature (Appendix C)
14. apply blood pressure cuff to arm
15. apply EMG disk to frontalis muscle (Appendix G)
16. allow two minutes for woman to adjust to EMG disks
17. plug EMG disk attachment into machine
18. adjust machine controls to pick up baseline reading

19. evaluate woman for uterine contractions

20. collect baseline criterion measures,

    A. muscle score readings
    B. pulse rate (15 seconds x 4)
    C. respiratory rate (15 seconds x 4)
    D. blood pressure

21. collect criterion measures every fifteen minutes

22. check the following every hour,

    A. disk application
    B. batteries

Appendix K

Experimental Participants Procedure Guide

During data collection the researcher will:

1. identify a potential participant
2. approach the potential participant
3. identify self
4. explain the study
5. verify that the woman meets study criteria
6. show the woman the consent form
7. explain the purpose of the consent form
8. read aloud the consent while the woman reads silently
9. invite questions about the study
10. allow the woman five minutes alone to consider the study and while outside room,

    A. check batteries in the EMG machine
    B. remove speaker wires from the EMG machine
    C. prepare EMG disks for use

11. return to room and invite questions
12. ask for woman's decison
13. supply copies of consent for signature (Appendix D)
14. apply blood pressure cuff to arm
15. apply EMG disk to frontalis muscle (Appendix G)
16. allow two minutes for woman to adjust to EMG disks
17. plug EMG disk attachment into machine
18. adjust machine controls to pick up baseline reading

19. evaluate woman for uterine contractions

20. collect baseline criterion measures

    A. muscle score readings
    B. pulse rate (15 seconds x 4)
    C. respiratory rate (15 seconds x 4)
    D. blood pressure

21. initiate audio biofeedback session (Appendix H)

22. collect criterion measures every fifteen minutes

23. check the following every hour,

    A. disk application
    B. batteries

24. initiate the Follow up Biofeedback Session (Appendix I)

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DISSERTATION APPROVAL FORM

Name of Candidate Sylvia Squires Britt

Major Subject Nursing

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