

MANAGEMENT OF POSTPARTUM BREAST ENGORGEMENT IN
NONBREASTFEEDING WOMEN BY MECHANICAL
EXTRACTION OF MILK

by

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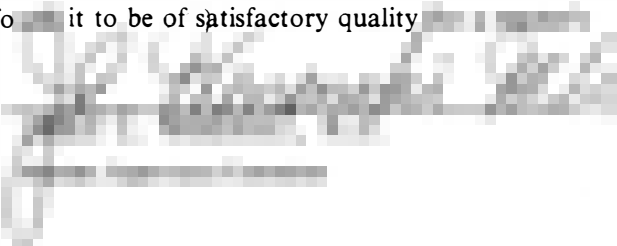
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ABSTRACT

The purpose of this study was to test the effectiveness of milk removal as a method of reducing the discomfort of postpartum breast engorgement in nonbreastfeeding women. Because of a small sample, statistical inference is not possible. The results suggest that the mechanical removal of milk is an effective way to increase the comfort and decrease the symptoms of engorgement in women who do not breast-feed their infants.

The course of breast involution was followed in 13 women representing the study sample. Minimal engorgement was experienced by 46% of the subjects. They required only a supportive bra to maintain comfort. A control group (N = 3) who experienced engorgement and followed standard management practice was compared to an experimental group (N = 4) who used a hand operated breast pump to relieve engorgement symptoms. Tissue resistance was measured in the lactiferous sinuses using the Pressure Gauge Model P-101. Subjective data were recorded concerning hardness, discomfort and leakage of milk in the breasts.

The subjects in the experimental group experienced a shorter, more comfortable course of breast involution. They took no analgesia nor used any other treatment for breast discomfort. There was no evidence of rebound engorgement or lactation stimulation.

Other findings not addressed by study questions were described using data collected from the control group. A general pattern of

engorgement was described: following an onset on the second post-partum day, severe engorgement was sustained for three days with a gradual return to normal on the ninth day. By correlating the measurements taken with the pressure gauge with clinical symptoms, breast engorgement was categorized according to severity.

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CHAPTER I

INTRODUCTION

During the first week postpartum many women who do not breast-feed experience breast engorgement accompanied by pain and lactation. In a drug related study, Morris, Creasy and Hohe (1970) reported that 90% of the placebo group experienced one of the three symptoms of engorgement: hardness, pain, or leaking. One third of this group complained of significant postpartum breast engorgement and discomfort. It is the nurse who must help the patient to adapt to the pain and frustration of engorgement.

A substantial amount of engorgement is caused by retention of milk. If it were possible to remove this milk without stimulating lactation, it seems that discomfort would be prevented rather than requiring adaptation to it after it occurs. This thesis explores the potential for mechanical removal of milk without lactation stimulation to reduce patient discomfort from breast engorgement.

Conceptual Framework

It is assumed that it is possible to use a hand operated breast pump to remove milk from the lactiferous sinuses without stimulating lactation. A review of the physiology of lactation, the natural weaning process and breast engorgement will produce facts to support this premise.

Lactation

The mechanism for lactation is dependent upon two key hormones. Prolactin stimulates the process of milk synthesis and its release into the alveoli and small ducts. Oxytocin induces the ejection of the milk from the acini and small ducts into the larger ducts and lactiferous sinuses where it can be removed by the suckling infant. However, during pregnancy, the effects of prolactin on the acini are antagonized by large amounts of circulating luteal and placental hormones. The sudden withdrawal of the luteal and placental hormones, estrogen and progesterone, at birth allow the prolactin to stimulate milk production.

The nipple and areola have numerous nerve endings which when stimulated initiate the prolactin and oxytocin reflex cycles (Tyson, 1977). Stimulation by the suckling infant elicits afferent neural impulses. These impulses travel simultaneously by different routes to pituitary areas involved with secretion and the release of milk. A prolactin releasing factor from the hypothalamus stimulates the anterior pituitary to release prolactin into the circulation. Prolactin then travels through the blood to the acini which are stimulated to synthesize and release milk. Within 30 seconds after the release of prolactin, oxytocin is released from the posterior pituitary. It also travels through the blood to the breast where it stimulates the contractile myoepithelium of the ducts to eject the milk into the sinuses.

Prolactin appears to be the key to lactation; the more prolactin that is secreted the more milk produced. The premise that tactile receptors for both the oxytocin and prolactin release seem to be

located in the nipple is supported by Cobo (1974). He reported that Sala, Luther, Arbolla, and Funes have shown that intermittent positive pressure applied to the nipples by means of a glass cup connected to a pressure pump, as well as thermal stimuli obtained by circulating water at 37°C, did not evoke any mammary responses. Sala, et al., stated that "sucking pressures and thermal stimulus play no part in oxytocin response" (1974, p. 157). It was reported by Jacobs and Doughaday (1974) that the use of a breast pump produces a deep pressure stimulus and may not contact the nipple directly, which results in only small increases of prolactin.

The regulation of lactation is a dynamic process. The amount of milk being produced is directly related to the amount removed from the breast. There is usually a delay of about 48 hours between an increased demand and a corresponding increase in the mother's milk supply. The secretion of prolactin is proportional to the degree and duration of nipple stimulation (Tyson, 1977). Increased suckling removes more milk and stimulates prolactin production thus causing additional milk to be produced.

The key factors to successful lactation include an intact hypothalamic-pituitary axis, regular prolonged removal of milk, adequate diet and fluids, and the mother's positive attitude toward nursing. Maternal emotional stimulation such as seeing the baby or hearing its cry may also elicit the secretion of prolactin and oxytocin.

Reduced lactation can result from many situations. Failure to remove milk obstructs capillary blood flow causing a backlog of milk in the acini which depresses milk production. An absence of suckling

causes inadequate prolactin and oxytocin production thereby slowing or stopping lactation. Maternal stresses have a deleterious effect through both a direct inhibition by epinephrine and an oxytocin inhibition by catecholamine antagonism. Deliberate reduction of lactation can be achieved through a planned weaning process.

Weaning

Weaning is the process by which a baby becomes accustomed to taking food from sources other than the mother's breast. Weaning is accompanied by a diminution of milk production. It is recommended that lactation suppression and weaning of the infant be accomplished slowly. Following a schedule recommended by La Leche League, Int. (1963), the nursing couple begins by eliminating one regular feeding time for at least 4-7 days. They then eliminate another regular feeding time for the same period, and continue in this manner until they are nursing one time per day. They can taper off using irregular feedings if necessary for the comfort of the mother. Prolactin stimulation is gradually diminished with less milk production every 24 hours. This effectively stops lactation while purposefully avoiding painful engorgement.

Engorgement

Engorgement is the ensuing hardness of the breasts accompanying the onset of lactation or overfilling of the breasts with milk at any time during the nursing experience. Engorgement of the breasts is a common condition following parturition. The onset is usually between the second and fourth days postpartum. Symptoms and discomfort vary from non-existent to severe. With engorgement the breasts become

heavier, larger, firmer, and more sensitive. In severe engorgement, the skin may become tight and shiny, and the lobules can be felt as hard lumps and the ducts as hard strings (Moore, 1978). The breasts may feel warm to the touch and there may be a transient elevation of systemic temperature (Pritchard & MacDonald, 1976). Leaking may occur with overdilatation of the alveoli and ductal system.

There is still controversy regarding the cause of engorgement. According to Greenhill and Friedman (1974) and Pritchard and MacDonald (1976) it is due to the venous and lymphatic dilatation that precedes lactation. As one third of the breast volume can be attributed to milk secretion and storage, Vorherr (1974) stated that it is also due to the alveolar accumulation of milk. While describing engorgement Newton and Newton noted:

Our conception of engorgement is that it begins with retention of milk in the alveoli. The alveoli become distended and compress surrounding milk ducts. This leads to the obstruction of the outflow of milk, further dilatation of the alveoli, and increased obstruction. If unrelieved, this may lead to secondary vascular and lymphatic stasis. (1951, p. 666)

In the study conducted by Newton and Newton (1951) to investigate the part played by milk in the development of engorgement, a scale of 0 to 4+ was used to measure engorgement. The clinical data collected indicated that there was a relationship between the amount of milk that could be removed mechanically from the breasts and a scale used to measure breast engorgement (Table 1). It was concluded that postpartum engorgement is primarily due to the retention of milk in the breast and in the presence of severe engorgement obstruction of the ducts prevents the removal of milk.

Table 1
Relationship of Degree of Engorgement
to Amount of Milk in the Breasts

Engorgement Scale	0	1+	2+	3+	4+
Average amount of milk removed (Gm)	5	50	76	110	36

Source: Newton & Newton, 1951, p. 665.

Adaptation to Engorgement

Adaptation theory can be applied to the nursing management of breast engorgement. Roy (1978, p. 23) describes "nursing's goal as to promote man's adaptation in the situations of health and illness," and the nurse must identify the person's level of adaptation to define the difficulties so that intervention may be taken to promote and effect that adaptation. By the use of the nursing process to assess the patient's physical and psychological response to the engorgement, and concluding that there is a problem, the nurse then takes the necessary steps to help the patient adapt to the situation. The nursing interventions at this time include clinical methods of lactation suppression and general reassurance that the engorgement will resolve in a day or two.

According to Roy, to assist man adapt to changes in his/her status of health, the nurse must gather data to assess a problem, define that problem, and select an approach which will promote the adaptation. Breast engorgement causes changes in physiologic needs. While collecting data, the nurse observes that the patient's breasts exhibit signs of engorgement--hardness and leaking from the nipple.

The patient reports that she is experiencing discomfort in her breasts. Defining the problem, the nurse may conclude that the discomfort is due to the presence of excess milk in the breasts. This is the response of the breast to the actification of prolactin due to the withdrawal of estrogen and progesterone. The problem is not the engorgement itself, but the discomfort experienced by the woman as a result of the engorgement. To help the patient adapt to the situation, the nurse must select an appropriate approach which will relieve the engorgement, relieve the discomfort, and facilitate the return of the breasts to the prelactation state.

The approach to promote adaptation varies as to whether or not the woman wishes to breastfeed. If she wishes to nurse, the infant is put to breast as often as desired or possible. Between feedings, the breasts may be bathed in warm water or wet packs applied. Gentle massage with stroking toward the nipple can be utilized. These procedures encourage circulation to relieve congestion and mobilize the milk from the lobules toward the lactiferous sinuses where it can be removed (Myles, 1975; Roy, 1975). The breastfeeding woman is encouraged to express enough milk from her breasts for comfort but not enough to upset the balance of supply and demand.

Breast engorgement management of nonbreastfeeding women, as outlined by DeLee (1913), was use of sedatives, restricted fluids, a saline cathartic for two consecutive days, and a firm breast binder. If engorgement was painful, either ice packs or warm compresses could be used. As a last resort, breast massage and expression of milk could be used to promote comfort.

Expression of milk was still recommended by DeLee in 1947 only as a last resort. The practice of expression of milk has not been generally advocated and has been in disfavor for many years. However, while investigating inhibition of lactation with Bromocryptine to reduce serum levels of prolactin, Roland & Schellekens (1973) mechanically emptied the breasts of some of the subjects to relieve excessive discomfort. Expression of milk from the breasts of non-breastfeeding women is not an entirely new practice.

The nursing approach to facilitate adaptation to engorgement and a return to the prelactation state for the nonbreastfeeding mother consists of ice packs, breast support (and in some places, binding), and use of analgesics. This is based on the premise that pressure on the breasts and on the ductor-lobar system as well as the milk within will suppress lactation. The ice packs serve to reduce edema while dulling the pain sensors. Analgesics reduce or relieve the accompanying pain of engorgement. Fluid restriction, laxatives, and colonic irrigation have not proven helpful (Greenhill & Friedman, 1974; Pritchard & MacDonald, 1976; Jenson, Benson, & Burak, 1977).

An alternate method to help the patient adapt to the engorgement used by some physicians is suppression of lactation through the use of medications. Estrogens, combinations of estrogen and testosterone, and prolactin suppressors are among the drugs that have been tried. All have had varying degrees of success. Some women experience rebound lactation following completion of drug suppression.

Regardless of the methods used, many women experience relief only with the normal involution of the breast. With the clinical suppression of lactation using restricted fluid intake, binding of

the breasts or use of a tight bra, no breast manipulation, ice packs, and analgesics, lactation ceases in one week; but the total mammary involution process takes about 3 months (Vorherr, 1974). It was reported by Haskins, Moszkowski & Cohen (1964) and Russell & Chambers (1975) that in the absence of sucking stimuli, lactation ceases 14 to 21 days after parturition. After studying the constituents of postpartum breast secretion, Kulski, Hartmann & Smith (1977) reported that neither was milk synthesis prevented nor was involution complete after 14 days of treatment with Bromocryptine. Prolactin levels in nonbreastfeeding women were reported to return to a nonpregnant level of 12-25 ug/l 2-3 weeks after delivery by Bonnar, Franklin, Nott & McNeil (1975).

Some women may not experience engorgement. This may be due to an early activation of the follicular apparatus of the ovary which would supply the necessary amount of estrogen to inhibit the anterior pituitary, which would in turn prevent the release of prolactin (Roland, Veprosky & Linhart, 1955). These women, then would be treated unnecessarily by a "blanket regime" of lactation suppressive drugs.

Purpose of the Study

The purpose of this study was to determine: 1) if milk removal by mechanical means could reduce the discomfort experienced by non-breastfeeding women having engorged breasts, 2) if removal of milk could be done without increasing lactation, 3) if milk removal reduced hardness or leaking, and 4) if lactation was not changed by milk removal, did milk removal change the pattern of involution.

Definitions

For the purpose of this study the following definitions of terms were used:

Primary Definitions

Analgesia: Analgesia is medication taken for the relief of pain or discomfort.

Discomfort: Discomfort is the aching in the breasts experienced by women as the result of engorgement and reported by her on a subjective scale of 0-4.

Engorgement: Engorgement is local congestion and distention with fluids (Miller & Keane, 1978). This condition of the postpartum breasts may accompany the onset of lactation. This was measured by tissue resistance of the breasts in the lactiferous sinuses as indicated by the readings on the pressure gauge.

Hardness: Hardness is the firmness of the breasts perceived by the woman and reported by her on a subjective scale of 0-4.

Inhibition of lactation: Inhibition of lactation is the prevention of milk production in the postpartum breast.

Lactation: Lactation is the process of milk production in the postpartum breast.

Leaking: Leaking is the escape of milk or colostrum from either nipple as reported by the women using a scale of 0-4.

Mechanical removal of milk: The mechanical removal of milk is the extraction of milk from the breasts with a hand operated breast pump. This was performed by the woman when she felt the need for relief of the discomfort in her breasts.

Pattern of involution: The pattern of involution is the return of the breasts to the prelactation state following the onset of lactation. This was measured by the number of days necessary for the breasts to return to the same pressure readings indicated by the instrument before the onset of engorgement.

Index Definitions

The subjective variables--hardness, discomfort, and leaking--were reported by the subjects using the following scales:

Discomfort

- 0 = comfortable, that is, she has no discomfort at all.
- 1 = slightly uncomfortable, that is, she feels tightness in her breasts.
- 2 = moderately uncomfortable, that is, she feels increasing tightness in her breasts, but the discomfort is bearable.
- 3 = very uncomfortable, that is, she feels severe tightness in her breasts and needs analgesia or nursing measures for relief which includes tight breast binding, cold packs, etc.
- 4 = extremely uncomfortable, that is, she feels severe tightness which is not relieved by analgesia and/or nursing measures.

Engorgement or subjective hardness

- 0 = breasts are soft, that is, she feels no change from the normal consistency of breast tissues which are soft with her palpation.
- 1 = breasts are slightly firm, that is, she can feel small areas of firmness which cannot be indented with her fingers with palpation.
- 2 = moderately firm, that is, she can feel large areas of firmness which cannot be indented with palpation.
- 3 = breasts very firm, that is, the total breast cannot be indented with palpation.

4 = breasts are hard and lumpy, that is, the breasts cannot be indented and she can feel knots and strings within her breasts.

Leaking

0 = no leaking observed.

1 = a spot on clothing less than 2.5 cm. in diameter.

2 = a spot larger than 2.5 cm. but less than 7 cm. in diameter.

3 = a spot larger than 7 cm. in diameter with occasional dripping from the nipple.

4 = constant dripping from the nipple.

Research Questions

The following research questions were addressed:

1) Whether or not nonbreastfeeding women with engorgement who had milk removed mechanically would experience less engorgement, less hardness, less discomfort, less leaking and take analgesics fewer times than nonbreastfeeding women with engorgement who did not have milk removed.

2) Whether or not nonbreastfeeding women with engorgement who had milk removed mechanically would follow the same pattern of breast involution as nonbreastfeeding women with engorgement who did not have milk removed.

3) Whether or not the mechanical removal of milk would influence lactation in nonbreastfeeding women with engorgement.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

The review of the literature is divided into two parts: those which are reports of investigation of engorgement using nondrug related studies and those which are drug related.

Nondrug Related Studies

The effectiveness of compression versus supporting breast binders was compared by Bristol (1966). She concluded that engorgement did not increase and the client experienced less tenderness with supporting brassiers or binders. She noted no difference in the amount of leaking with the use of support rather than compressive binders.

Tools for breast engorgement measurement were developed by Petersen (1967) and Grissler (1967). Petersen reported that the majority of the mothers in her experimental sample had an increase in chest circumference with breast engorgement. There was no evidence of a change in skin temperature of the breasts, and there was a decrease in skin tension. She reported that there were no significant differences between the experimental and control groups. The tool described by Grissler was used in this study and is discussed in Chapter III and described in Appendix C.

Drug Related Studies

The effects of fluid loading for 48 hours was studied by Roberts (1970). She concluded that fluid loading was ineffective but that estrogens successfully suppressed lactation in 88% of the subjects. Buckman, Kaminisky, Conway and Peake (1973) investigated successful prolactin suppression with 20cc/Kg/30 min. The results indicated that 48 hours is not sufficient time for therapy, and the average 120 pound woman would have to drink more than a liter of fluid every half hour for this to be effective.

Daw and McKinley (1973) compared the use of estrogens with "natural" suppression which consisted of fluid restriction, binding of the breasts, use of diuretics, and analgesia. They concluded that natural inhibition had few complications and that estrogen therapy was not necessary. Rebound lactation occurred in 94% of the estrogen therapy subjects and 3% developed infections or abscesses. None of the "natural" therapy subjects experienced any of these.

The use of diuretics and analgesia were assessed by Russell and Chambers (1975) when engorgement was not managed by routine estrogen therapy. Their results indicated that 57% of the subjects required no analgesia, and 40% required neither diuretics nor analgesia. However, 25% of the total group required both. They concluded that breast binding, use of diuretics, and analgesia are effective, safe, and comfortable for the patient. Their results indicated that lactation ceased after 2-3 weeks regardless of the therapy used.

From the late 1930's until the 1950's, estrogen therapy was used in high dosages for lactation suppression. Following an extensive

review of the literature, Roland, Veprosky & Lindhart (1955) concluded that each investigator had obtained reasonably good results with whatever product was used. They held the opinion that good results would be obtained with any of the endocrines as long as it was started early enough postpartum and continued long enough to inhibit prolactin. They also presented a list of 11 criteria for the ideal endocrine suppressant.

By the late 1960's, work by Turnbull (1968) initiated concern over the accumulating evidence of serious side effects when estrogen was used as a lactation suppressant. Many physicians, therefore, returned to previous standard engorgement management.

Some physicians continued to use estrogens despite the evidence, and in a study of various preparations, Vorherr (1974) concluded that the most efficient and least hazardous agent was an intramuscular injection of the long acting androgen-estrogen combination, Deladumone. Several other investigators also concluded that Deladumone was the drug of choice (Markin & Wolst, 1960; Bare, Zaleznik & Levin, 1963; Morris, Creasy & Hohe, 1970; and Schwartz, Evans, Garcia, Rickels & Fisher, 1973).

Researchers have investigated other drugs such as prolactin antagonists and inhibitors. Bromocryptine (CB-154) has been reported to be highly successful (Rolland & Schellekers, 1973; Brun de Re, del Pozo, de Grandi, Friesen, Hinselmann & Wyss, 1973). Rebound lactation was thought to be due to an inadequate dosage over too short a period of time (De Whirst, Harrison & Bisway, 1977; Kulski, Hartmann, Martin & Smith, 1977).

CHAPTER III

METHODOLOGY

Design

In this study the use of mechanical removal of milk for the relief of discomfort accompanying breast engorgement was investigated. Control and experimental groups were utilized. Manipulation of the independent variable was the removal of milk by subjects in the experimental group who experienced discomfort from engorgement. A subgroup of subjects in the experimental group did not experience sufficient discomfort to withdraw milk. There were subjects in the control group who experienced discomfort from engorgement and some who did not experience discomfort to the degree of needing clinical treatments. Table 2 reflects the distribution of the sample.

Table 2

Sample Groups According to Engorgement and Discomfort

	Group	
	Control	Experimental
Engorgement with discomfort	No treatment	Treatment
No engorgement with no discomfort	No treatment	No treatment

Due to the difficulty in obtaining a large sample and to the time limitations a sample of convenience was chosen. While the results obtained with a small sample are not conclusive, they do give direction for further research.

Assumptions

This study was based on the following assumptions:

1. All subjects experienced a normal course of postpartum breast involution.
2. Postpartum breast engorgement and involution were not affected by maternal age, gestation, number of previous pregnancies, the course of pregnancy, or the type of labor and birth experienced by the mother.
3. The subjects were honest in reporting and recording symptoms and data.

Sample

A sample of 17 subjects was obtained from the practices of private physicians. The subjects delivered infants at a local hospital between the dates of March 9 and April 1, 1980. The first six subjects were assigned to the control group to avoid the halo effect; the remaining 11 subjects were assigned to the experimental group.

Subjects were selected according to the following criteria:

1. Nonbreastfeeding women who delivered infants of at least 37 weeks gestation.
2. Who received no lactation suppressants.
3. Who received regional, local or no anesthesia for the delivery of the infant and placenta.

4. Who experienced a normal, spontaneous, low or mid-forceps delivery of a single infant.

5. Who expressed willingness to participate.

There was a loss of four women from the sample. One woman in the control group withdrew due to personal problems at home. From the experimental group, three women withdrew giving the following reasons: 1) a dislike for extracting the milk while preferring to use her time-tested method for discomfort and relief, ice packs, 2) a desire to breastfeed, and 3) a time commitment to a critically ill infant.

The demographic data from the sample population are shown in Table 3. The mean gestation of the two groups was the same at 39.6 weeks. The range of previous pregnancies was 0-4 and the means were 1.5 and 1.6 respectively. There was a difference in age as the mean of the control group was 23.4 and that of the experimental group was 26.3. All subjects were caucasian and all were married.

Table 3
Demographic Data of Sample Population

		Group	
		Control	Experimental
Number		5	8
Age	Range	18-31	18-36
	Mean	23.4	26.3
Previous Pregnancies	Range	0-4	0-4
	Mean	1.6	1.5
Gestation	Range	38-41	37.42
	Mean	39.6	39.6

A comparison of courses of pregnancies shows that one of five subjects in the control group had some problem during pregnancy as compared to one in eight in the experimental group. The problems experienced were bleeding in the first trimester or elevated blood pressure. Problems in labor and delivery were encountered by one of five of the control group and four of eight of the experimental group. This included an extended first stage of labor, fetal bradycardia, retained placenta and a low apgar score. None of the women received Demerol or Vistaril, the most commonly given labor drugs at the hospital. Pitocin was given to one of five of the control group and one of eight of the experimental group. Paracervical blocks were given to two of five of the control group and three of eight of the experimental group. All women had anesthesia for delivery and/or repair of the episiotomy. In the control group, three of five had pudendal blocks and two had epidural blocks. In the experimental group one of eight had a pudendal block, five had epidural blocks and two had local infiltrations. Normal spontaneous deliveries were experienced by four of five of the control group and three of eight of the experimental group. The other subjects had forcep deliveries. Of the five problems encountered in labor and delivery, four subjects had epidural blocks and one had a paracervical and a pudendal block. All women in the sample used medication for postpartum analgesia. The drugs included Percodan, Tabloid #3, Tylenol #3, and plain Empirin.

Instruments

Several instruments were used in the study. These were:

1. The Loyd-B-Pump, a non-electric, hand operated breast pump manufactured by Lupuco, Ltd., was used to remove milk from the engorged breasts of the experimental subjects. A sketch will be found in Appendix A.

2. Data were recorded on prepared forms (Appendix B) by the patients and the investigator. The patients recorded data regarding medications and treatments as they occurred. Data regarding discomfort, hardness, leaking, and pressure gauge readings were recorded three times daily by the investigator.

3. Breast engorgement was objectively measured by the use of the Pressure Gauge P-101. The instrument, based on a principle similar to that of a tonometer, was designed by Roger Salaman* for Natalie Geissler (1967) to measure breast engorgement. A sketch, the purpose and operation of the instrument are located in Appendix C. The instrument was validated by Geisser as 1) results were reproducible at the same site of measurement and 2) differences were measured between the first and third days in the breasts of engorged women while showing no differences in patients with no clinical symptoms of engorgement. Geissler concluded that a disk size of 2.4 cm. at a depth of 10 mm. would best measure tissue resistance within the breast. She reported that this disk size 1) gave a larger difference between the first and fourth days in all patients with engorged breasts, 2) normal skin turgor did not interfere with the

*Mesa Instruments, 72484 Panorama Dr., Boulder, Colo. 80303.

readings, and 3) the instrument was tolerated by the breast tissue causing no discomfort to the patients. Geissler did not clearly define engorgement, reporting only that tissue resistance was greatly increased with engorgement.

In this study, the 2.4 cm. disk was used a depth of 10 mm. and readings of 3.5 or less were reproducible. The women were not breastfeeding and some experienced a high degree of engorgement. With severe engorgement readings were not reproducible and due to the women's discomfort, were often deferred. Deferred pressure readings were assigned a value of 8 as the highest obtained was 6.5. The pressure readings are calibrated from 0-10 and a graph depicting the corresponding tissue resistance in grams per square centimeter is found in Appendix C. It should be noted that tissue resistance is not in direct linear relationship to the dial readings.

Following data collection, recalibration showed that the instrument gave the same corresponding readings as before the study began.

Procedure

Initial data were collected over a 4 1/2 week period by the investigator; follow-up data were obtained for an additional 2 weeks. Prior to data collection the Obstetrics and Gynecology committee and the nursing administration at the hospital were contacted by the investigator and their written consent to conduct the study obtained. The investigator met with the nursing personnel to explain the study and answer questions. An abstract was posted in the postpartum and labor/delivery units. The patients meeting the criteria were

initially contacted by the investigator before delivery. If the patients were in active labor or sedated, they were contacted within two hours of delivery. They were given an explanation verbally and in writing (Appendix D) and written agreement to participate in the study was obtained.

Confidentiality was maintained; the names of the subjects were not released to any person or agency. All data were identified by number. Participants were free to withdraw at any time.

On initial contact, baseline data regarding the symptoms of breast engorgement were obtained and recorded. The scales for hardness, discomfort, and leaking were shown and explained to the participants. The instrument was demonstrated on the woman's arm before measurements were taken on her breasts. The subject was placed in a semi-Fowler's position. The instrument was placed midline 4 cm. above the nipple to measure tissue resistance in the lactiferous sinuses. To insure that future readings would be taken at the same location, the site was marked with ink. Tissue resistance was measured on both breasts and the mean calculated to obtain a single reading per observation.

Data collection continued until the pressure readings returned to the baseline measurements obtained during the initial contact. Pressure readings and the subjective reports were recorded three times a day at approximately 0800, 1400, and 2000 hours. The subject recorded all medications taken, the time, purpose and if for pain, whether or not relief was obtained. Data were recorded on the forms in Appendix B.

Subjects in the experimental group were asked to test a method for the relief of the discomfort associated with breast engorgement. When the women needed relief, they were asked to extract milk from their breasts using a hand operated pump (Appendix A). They were encouraged to take analgesia or follow conventional treatment for engorgement if their discomfort was not relieved. After the rating scale explanation, the investigator suggested that milk should be removed before a discomfort index of three was reached as it was felt that excessive milk would result in greater discomfort and obstruction which would in turn prevent the extraction of milk. A tentative goal was suggested: to maintain a comfort index of two or as they judged their own needs and desires for comfort. The use of the breast pump was explained. The investigator offered to visit at any time if assistance was desired or needed.

As the symptoms of engorgement either had not occurred or if present, had not resolved when the women were discharged from the hospital, the investigator went to their homes to take pressure readings. This was done at the patient's convenience as close as possible to the prescribed times.

Follow-up data obtained by telephone interview were used to ascertain the reoccurrence of breast engorgement symptoms. Contacts were made two, three, and four weeks postpartum.

CHAPTER IV

RESULTS

The variables measured in this study were tissue resistance, hardness and discomfort of the breast and leakage of milk. These will be discussed according to each variable and the research questions.

Sample

The subjects in the study experienced varying amounts of engorgement. Tissue resistance at a pressure reading of 2.0 was designated as the onset of engorgement since all subjects who reached this pressure either experienced severe clinical symptoms or used the breast pump for relief of discomfort. Little or no engorgement was experienced by some subjects in both the control and experimental groups. Table 4 shows into which groups subjects were placed and whether or not they experienced engorgement.

Little or no breast engorgement was experienced by six of the thirteen women in the sample. Two were from the control group and four were from the experimental group. All of the women returned to their initial pressure readings by the fifth postpartum day. Individual pressure readings never exceeded 1.6 with a mean of 1.1. There was little deviation from initial pressure readings to maximum measurements. These subjects reported small amounts of leaking. Although their discomfort and breast firmness were higher than would

Table 4
 Number in Sample Groups According to
 Engorgement and Discomfort

	Group	
	Control	Experimental
Number with engorgement with discomfort	3 No treatment	4 Treatment
Number with no engorgement with no discomfort	2 No treatment	4 No Treatment

indicated by the pressure readings, most of the subjects took little analgesia for the relief of breast discomfort and none used any clinical treatments (ice packs, binding, breast pump) other than a supportive bra. The one subject who took a large number of analgesics indicated that these were for both mild breast and episiotomy discomfort. Four of the six women took no analgesia for breast discomfort.

The remaining subjects in the control group (N = 3) experienced moderate to severe discomfort from engorgement for approximately five days. The remaining subjects in the experimental group (N = 4) experienced sufficient discomfort with breast engorgement to seek relief by mechanically removing milk with the breast pump for five days. As the purpose of this study was to test the effectiveness of the mechanical removal of milk for the relief of breast discomfort with engorgement, the variables for these subjects will be discussed in response to the research questions.

Comparison of Variables of the Total Sample

Pressure Readings of Tissue Resistance

Breast tissue resistance of the subjects in the study was measured using the pressure gauge. Pressure measurements indicated the extent of the engorgement and the length of time for breast involution. Initial pressure readings of the sample varied from 0.3 to 1.1 with a mean of 0.6. Involutional pressure readings were similar with a range of 0.4 to 1.0 and a mean of 0.7. The extent of breast engorgement and the length of time for involution differed between the groups.

The means of postpartum pressure readings taken daily from the sample is shown in Figure 1. The most obvious point demonstrated is the difference in mean pressure readings of the control group having severe symptoms of engorgement and groups with little engorgement or following the experimental treatment pattern. There appeared to be no difference in the pressure patterns exhibited in either the control or experimental groups with little or no engorgement. The length of the period of involution varied with the amount of engorgement. The group of subjects experiencing little engorgement returned to their initial readings by the fifth postpartum day, while those who developed major symptoms of engorgement or used the breast pump reached initial readings by the ninth day.

Breast Hardness

A graph depicting the mean breast hardness reported by each group daily is shown in Figure 2. The control group subjects who experienced engorgement reported very firm breasts (scale of 3) for

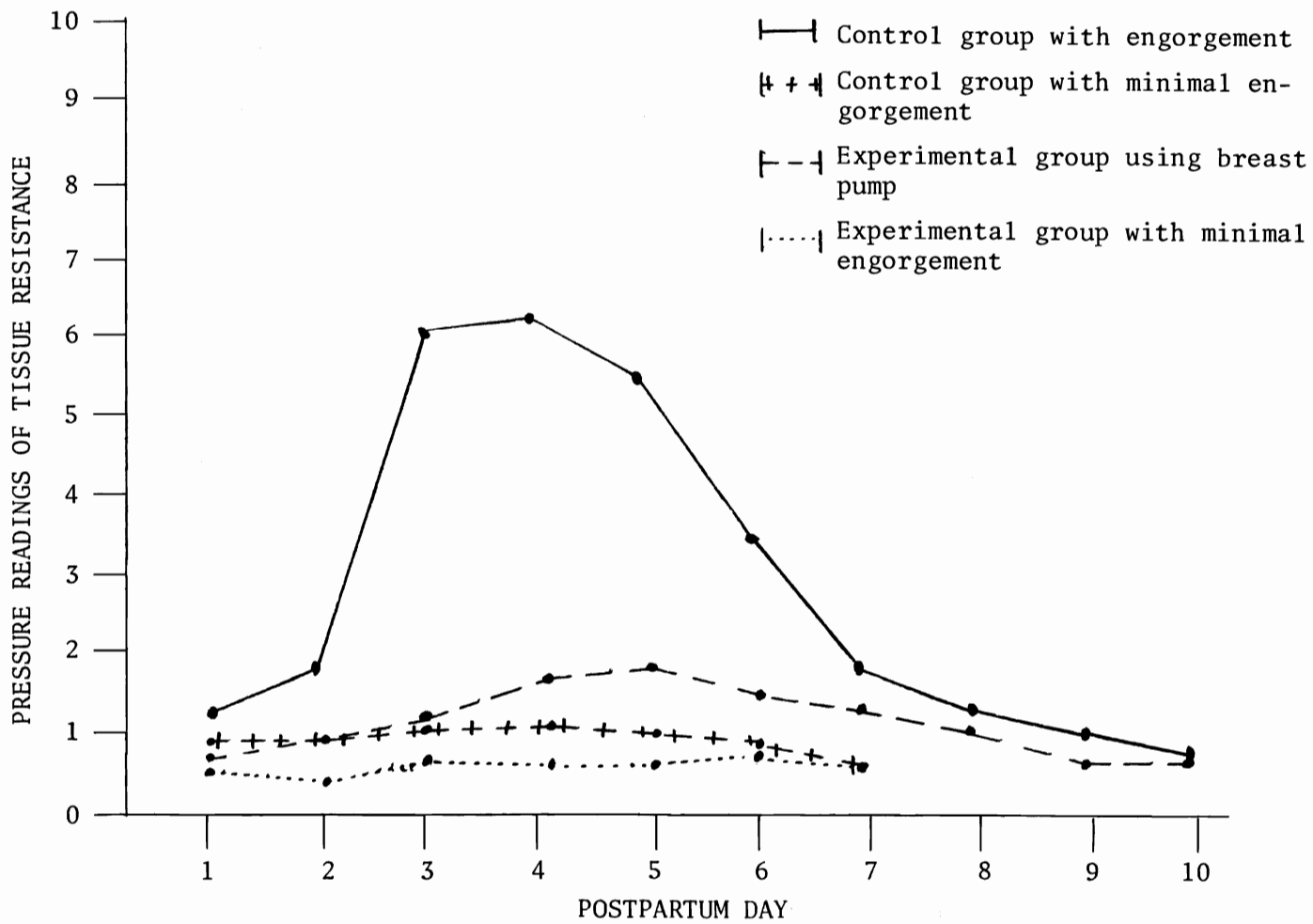


Figure 1. Comparison of group postpartum breast tissue resistance: means of readings per day. Control group with engorgement (N = 3); control group with minimal engorgement (N = 2); experimental group using breast pump (N = 4); experimental group with minimal engorgement (N = 4).

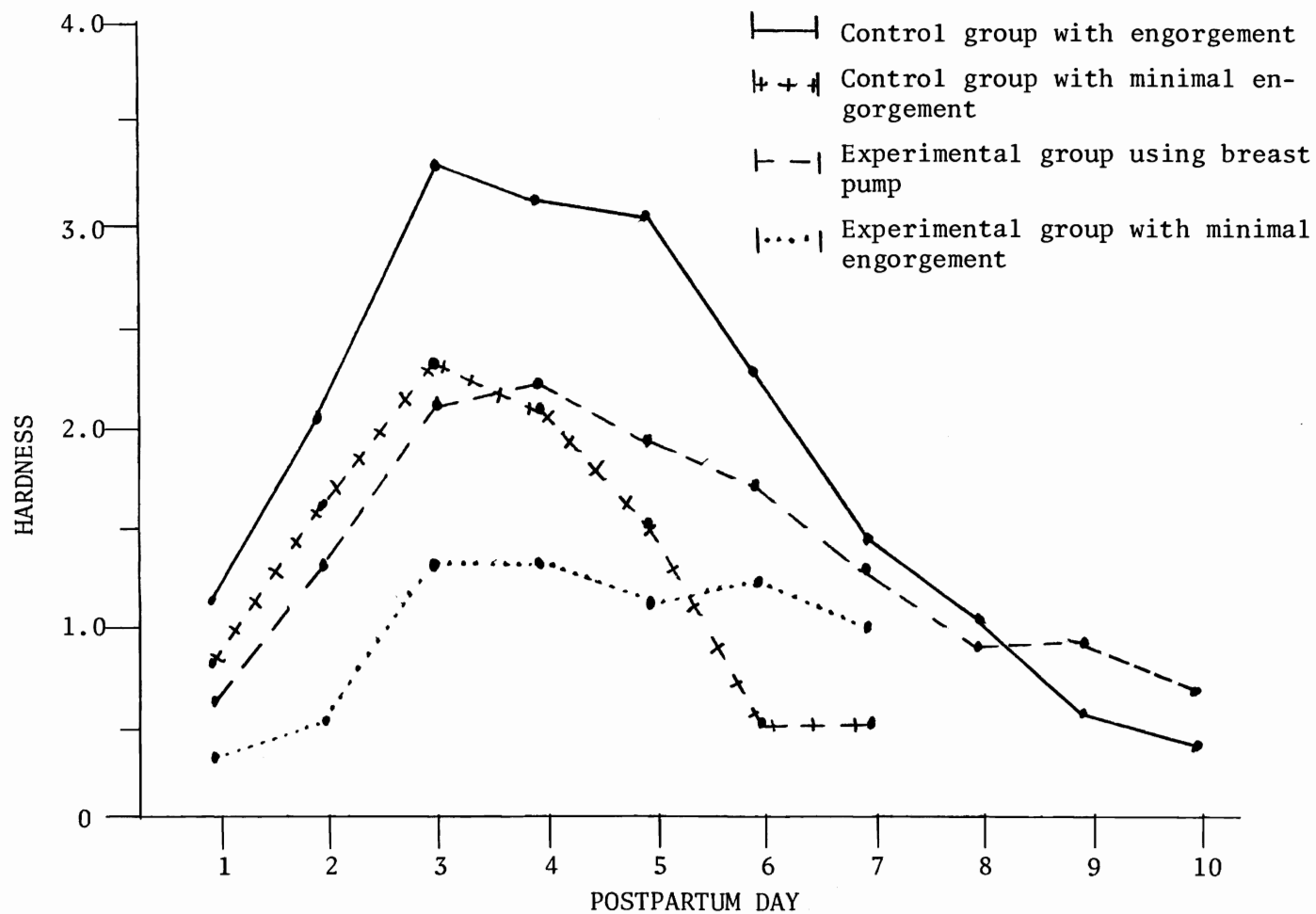


Figure 2. Comparison of group postpartum breast hardness: means of readings per day. Control group with engorgement (N = 3); control group with minimal engorgement (N = 2); experimental group using breast pump (N = 4); experimental group with minimal engorgement (N = 4).

over 2 days. The women in the experimental group who pumped their breasts and those in the control group who had little engorgement reported 1 1/2 days of moderate firmness (scale of 2). Subjects in the experimental group who had little engorgement reported slight firmness (scale of 1).

Discomfort

The means of postpartum breast discomfort reported daily by each group is shown in Figure 3. The patterns of discomfort reported by each group appears to be similar to their respective patterns of hardness. The women in the control group who developed symptoms were moderately uncomfortable (scale of 2) for over three days. The women who pumped their breasts peaked slightly below moderate discomfort on the fourth day. The subjects in the experimental group who had little engorgement reported slight discomfort (scale of 1). Those in the control group with little engorgement reported moderate discomfort for a short time on the third postpartum day.

Leaking

The means of postpartum leaking are shown in Figure 4. Minimal leaking was reported by all subjects in the experimental group. The women in the control group with little engorgement usually had occasional minimal leaking, but on the fourth day reported slightly more. However, the control group who experienced engorgement reported much larger amounts of leaking over several days.

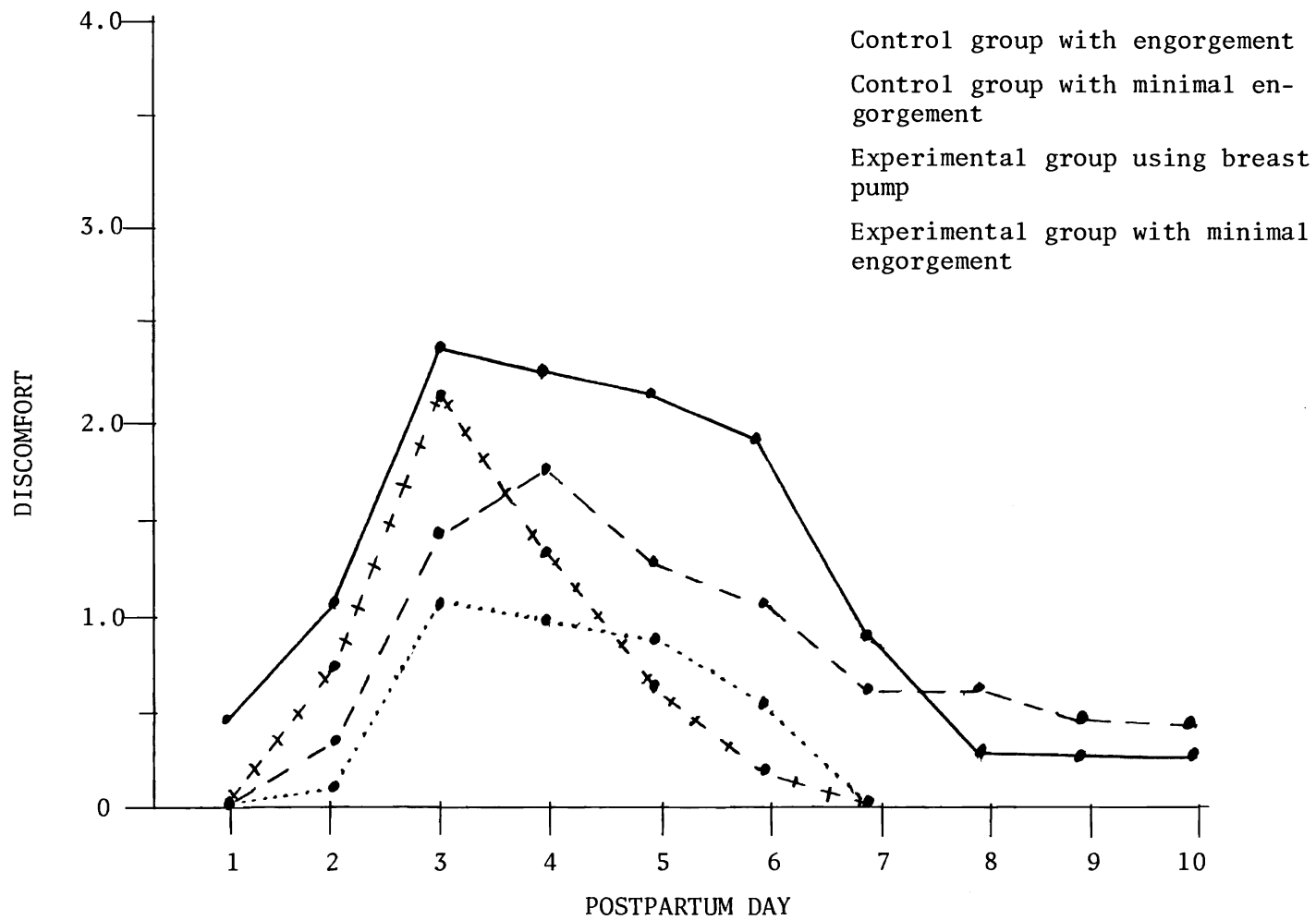


Figure 3. Comparison of group postpartum breast discomfort; means of readings per day. Control group with engorgement (N = 3); control group with minimal engorgement (N = 2); experimental group using breast pump (N = 4); experimental group with minimal engorgement (N = 4)

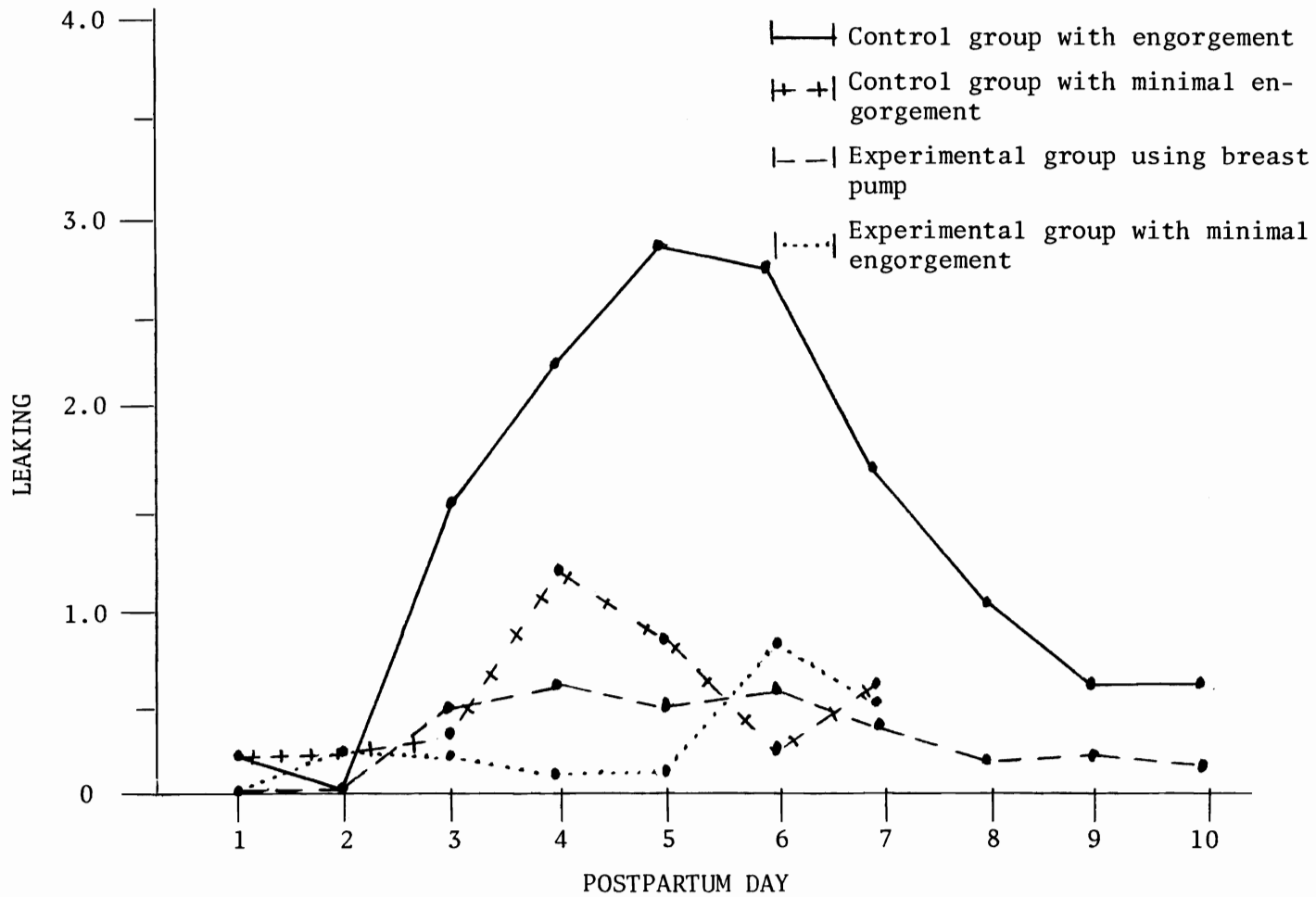


Figure 4. Comparison of group leaking of milk: means of readings per day. Control group with engorgement (N = 3); control group with minimal engorgement (N = 2); experimental group using breast pump (N = 4); experimental group with minimal engorgement (N = 4).

Pattern of Breast Engorgement in the Control Group

Using the objective data obtained in the pressure readings from the control group who experienced engorgement, this study established the following patterns of engorgement: for approximately 24 hours before the onset of engorgement at a mean of the evening of the second postpartum day there was a gradual increase in pressure to a reading of 2.0; after the measurement of 2.0 was reached, there was a rapid increase in pressure over the next eight hours. The peak of engorgement was maintained for two days and then there was a rapid decrease to a pressure of 4.5. A leveling off period of 16 hours was followed by another rapid decline to a reading of 3.0. There was then a gradual return to pre-engorgement pressure measurements and breast involution.

From the control group tissue resistance measurements, the following categories for breast engorgement were established:

- - 1.5 = no engorgement
- 1.6 - 2.5 = mild engorgement
- 2.6 - 3.5 = moderate engorgement
- 3.6 - --- = severe engorgement

These categories could be refined with further study and through statistical correlations with hardness and discomfort. The categories are designated as a result of their relationship to clinical symptoms; the breast engorgement index rises in conjunction with increasing pressure readings. Although leaking follows the same curve, it rises, peaks, and declines 24 hours after the others. This implies internal validity of the categories and reliability of the instrument.

Research Questions

Research Question 1

Whether or not nonbreastfeeding women with engorgement who had milk removed mechanically would experience less engorgement, less hardness, less discomfort, less leaking, and take analgesics fewer times than nonbreastfeeding women with engorgement who did not have milk removed.

Engorgement. Engorgement was measured objectively with the pressure gauge. The breast tissue resistance readings for the control and experimental groups are illustrated in Figure 5. The shape of the control group's curve is unimodal showing severe engorgement for over three days. The experimental group has a symmetrical curve with two small peaks of mild engorgement on the third postpartum day. This mild engorgement lasted for approximately 2 1/2 days.

In summary, the breast tissue resistance as measured by the pressure readings observed in the experimental group (Fig. 7) were markedly and consistently lower than those of the control group (Fig. 6).

Hardness. Hardness in the breasts as reported by the control group is shown in Figure 6, while that of the experimental group is shown in Figure 7. Hardness in the control group is reflected in a normal curve with a high of "very firm" breasts (scale of 3) for 2 1/2 days. The experimental group hardness curve is skewed to the left peaking at moderate firmness. The subjects in the experimental group perceived moderate firmness for two days.

In summary, the experimental group (Fig. 7) reported less hardness over a shorter period of time than did the control group (Fig. 6).

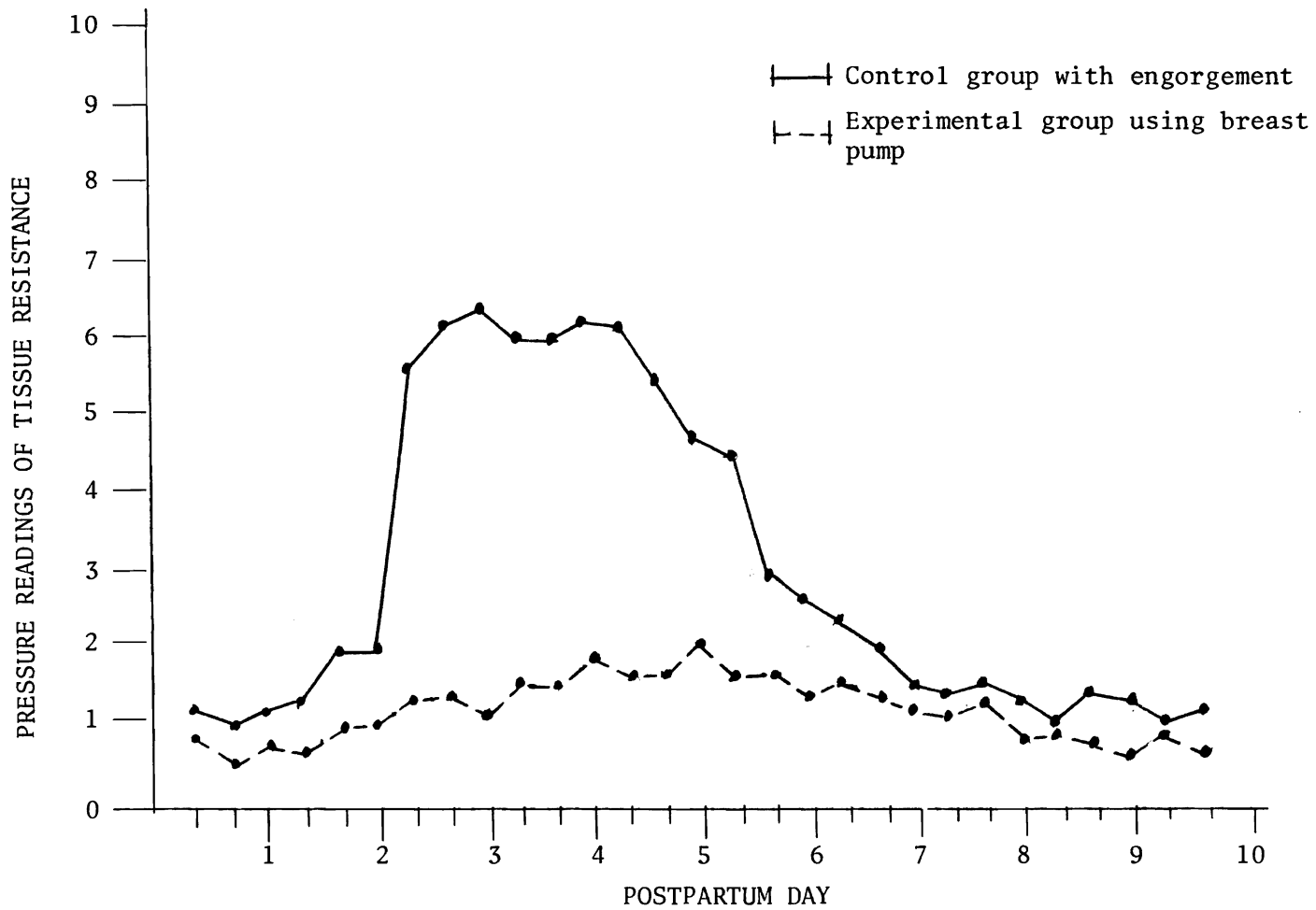


Figure 5. Comparison of postpartum breast tissue resistance observed at 0800, 1400, and 2000 hours. Control group with engorgement (N = 3); experimental group using breast pump (N = 4).

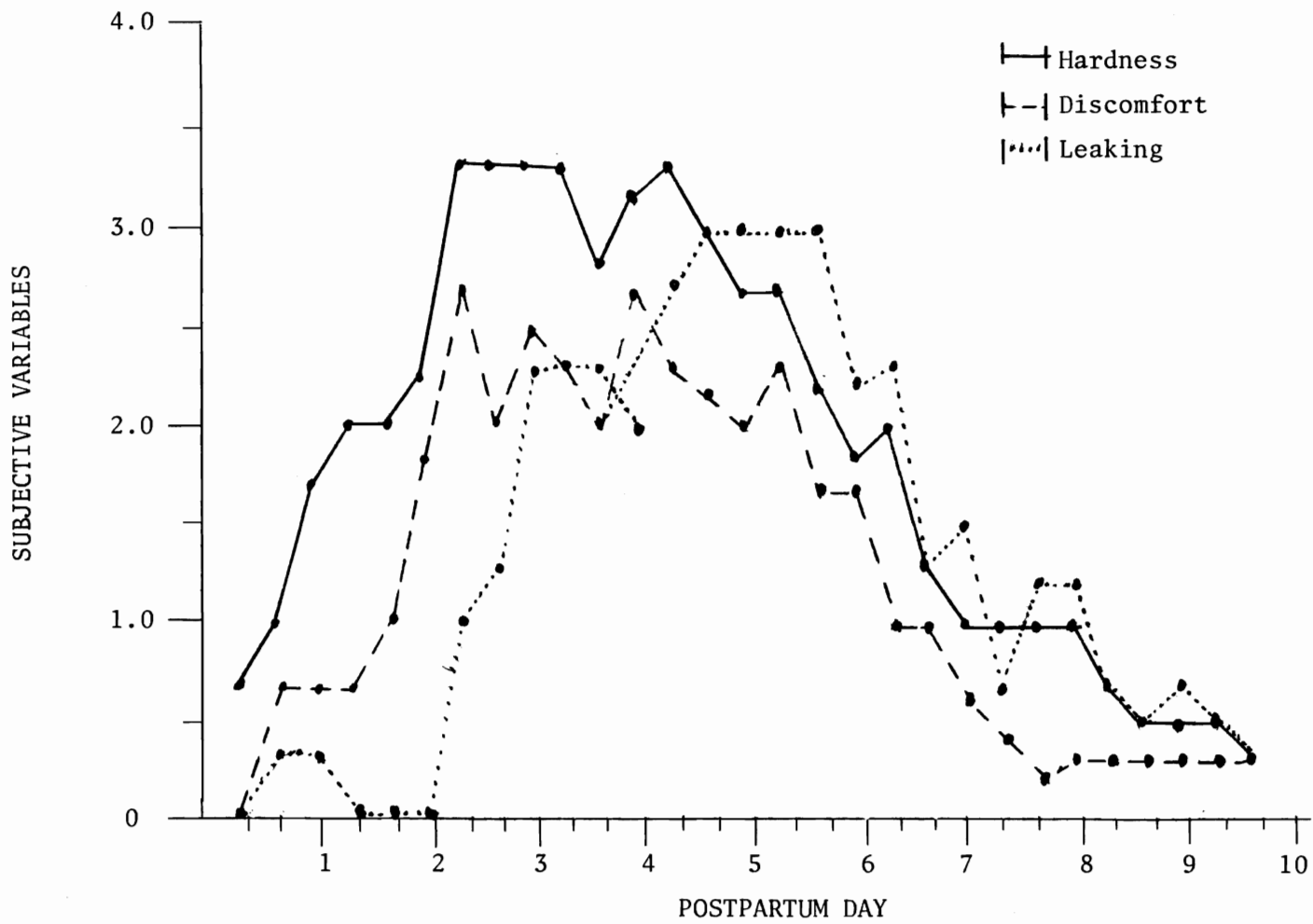


Figure 6. Correlation of subjective variables: control group with engorge-
ment (N = 3). Observed at 0800, 1400, and 2000 hours.

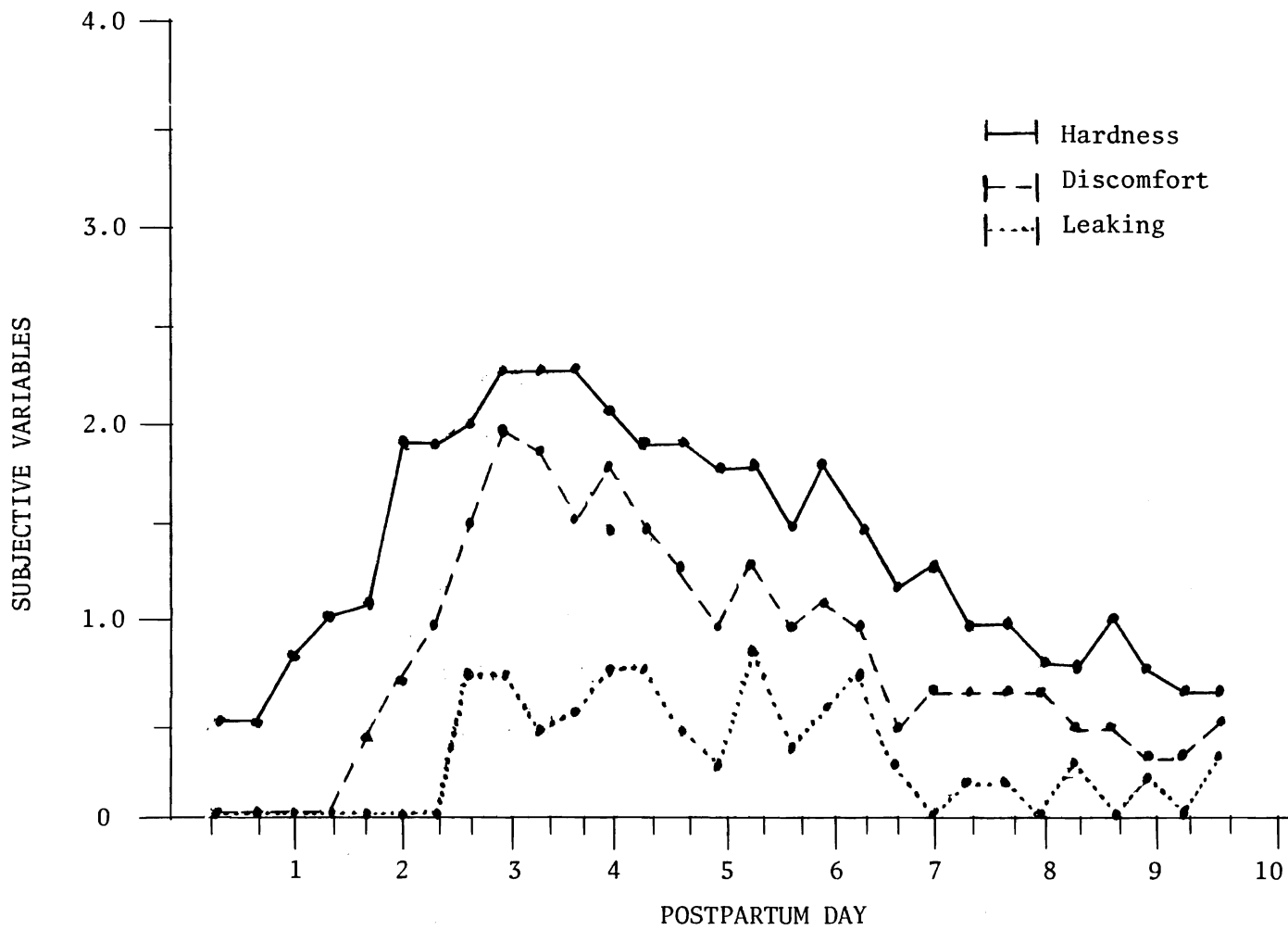


Figure 7. Correlation of subjective variables: experimental group using breast pump (N = 4). Observed at 0800, 1400, and 2000 hours.

Discomfort. The graph of discomfort measurements reported by the control group (Fig. 6) is a multimodal curve with three peaks approaching "very uncomfortable" (scale of 3) over a two day period from the morning of the third to the evening of the fourth postpartum days. The experimental group curve (Fig. 7) is unimodal with the peak indicating moderate discomfort (scale of 2) the evening of the third postpartum day. The women in the experimental group experienced moderate engorgement for a mean of eight hours.

In summary, until the seventh postpartum day as both groups were approaching breast involution, the experimental group consistently reported a lower index of breast discomfort (Fig. 7) than did the control group (Fig. 6).

Leaking. The milk leaking measurements reported by the control group (Fig. 6) demonstrated a unimodal curve. The experimental group curve shows several small peaks all below an index of 1.0 (Fig. 7). The control group reported a mean of moderate leaking (scale of 2) over four days with large amounts of leaking for a mean index of 3.0 the fifth and sixth postpartum days. The experimental group reported minor and occasional leaking (below a scale of 1) for a mean of four days.

In summary, the experimental group consistently reported markedly lower amounts of leaking (Fig. 7) than did the control group (Fig. 6).

Relief of Discomfort. Both groups reported similar means of total analgesia taken: the control group with 7.7 and the experimental group with 8.0. For the relief of breast discomfort the control group took analgesia a mean of 2.7 times and the experimental

group took none. The numbers of times analgesics were taken are shown in Table 5.

Table 5
Frequency That Postpartum Analgesia Was Taken

		Group	
		Control	Experimental
Number		3	4
Total number of times analgesia was taken	Range	5-11	0-13
	Mean	7.7	8
Number of times analgesia was taken for breast discomfort	Range	1-4	0
	Mean	2.7	0

In addition to the analgesics, one woman in the control group used a breast binder for two days and another used ice packs four times for discomfort relief. The third woman in the control group reported that she had obtained relief when she had "squeezed some milk out" when she experienced constant dripping. The experimental group used only a supportive bra supplemented by the breast pumping.

In summary, there appear to be major differences in the methods used for postpartum pain relief. Both groups took analgesia the same number of times for the relief of episiotomy pain and cramping; only the control group took medication for the relief of breast discomfort. The women in the control group used additional common measures for breast comfort other than a bra and drugs. The women in the

experimental group used only the bra and maintained comfort with the breast pump.

Research Question 2

Whether or not nonbreastfeeding women who had milk removed mechanically from their engorged breasts would follow the same pattern of involution as nonbreastfeeding women who did not have milk removed.

Initial Data. The mean total time for the control group to return to pre-engorgement pressure readings was 9.1 days with a range of 3 to 14 days. The mean total amount of time for the experimental group to return to pre-engorgement readings was a mean of 6.0 days with a range of 1.7 to 9.7 days. The breast involution for the experimental group took three days less than that of the control group. The amount of time for breast involution is shown in Table 6.

Table 6
Comparison of the Number of Days
for Breast Involution

		Group	
		Control	Experimental
Number		3	4
Number of days for breast involution	Range	3-14	1.7-9.7
	Mean	9.1	6.0

Subsequent Data. All women in the sample were contacted by telephone at two, three, and four weeks postpartum to ascertain the reoccurrence of breast engorgement symptoms. The subsequent data for the sample are shown in Table 7.

Table 7

Subsequent Postpartum Data of Total Sample Means
of Hardness, Discomfort, and Leaking

Engorgement		Group			
		Control		Experimental	
		With	Without	With	Without
Number		3	2	4	4
Two weeks postpartum	Hardness	0	0	0	0
	Discomfort	0	0	0.1	0
	Leaking	0.3	0.3	0.6	0.4
Three weeks postpartum	Hardness	0	0	0	0
	Discomfort	0	0.2	0	0
	Leaking	0.3	0	0.3	0
Four weeks postpartum	Hardness	0	0	0	0
	Discomfort	0	0	0	0
	Leaking	0.3	0	0	0

Two weeks postpartum all women reported that they had had no hardness in their breasts. One woman in the experimental group who had pumped her breasts reported "one tiny area" of discomfort in one breast; all other women in the sample reported that their breasts were completely comfortable. Occasional leaking was reported by all groups.

Three weeks postpartum all women reported no hardness in their breasts. One woman from the control group who had experienced mild engorgement reported some minor discomfort which was relieved by wearing a bra; all other women were comfortable. Occasional leaking was

reported in the groups who had experienced breast engorgement, but none was reported by the women who had had minimal engorgement.

Four weeks postpartum all women reported no hardness or discomfort in their breasts. Two women in the control group (66%) reported that they were still experiencing occasional leaking; all others reported none.

In summary, rebound lactation or engorgement was not experienced either by the control group or the women who removed milk with the breast pump. Occasional leaking was the most common symptom reported and persisted for the control group subjects throughout the data collection period. No woman perceived hardness in her breasts after the initial data collection ended. Minor discomfort was reported by the experimental group in the second week postpartum and by the control group in the third week. At no time after the subsidence of the primary symptoms of engorgement did significant clinical signs reappear.

Research Question 3

Whether or not the mechanical removal of milk would affect lactation in nonbreastfeeding women.

Symptoms of engorgement were decreased, but the experimental group removed milk for the same length of time that the control group experienced moderate to severe engorgement symptoms. There was no evidence in this study that lactation was increased or decreased by the mechanical removal of milk.

CHAPTER V

CONCLUSIONS, RECOMMENDATIONS, IMPLICATIONS

Conclusions

Because of a small sample, statistical inference is not possible. Although the sample is small, the results of this study suggest that the mechanical removal of milk is an effective way to increase the comfort and decrease the symptoms of engorgement for women who do not breastfeed their infants. None of the women in the experimental group had evidence of increased lactation nor did they have rebound engorgement. The subjects in the experimental group took no analgesia or clinical treatment for breast discomfort. They had a shorter, more comfortable course of breast involution than did the control group.

Other Findings

Subjects with Minimal Engorgement

One important and unexpected result of this study was the number (6 of 13) of women who experienced insufficient engorgement to warrant intervention. These women were comfortable using only a supportive bra and most of them used few analgesics.

Categorization of Engorgement

Using the objective data obtained from the control group who experienced moderate to severe engorgement, a pattern of engorgement

was described. Breast engorgement was categorized according to severity.

Course of Engorgement

The onset of engorgement for the sample population varied from the second to the fourth postpartum afternoons, a range of 56 hours. This is consistent with the literature.

Pritchard & MacDonald (1976) and Moore (1978) indicated that engorgement lasts 1-2 days. The control group in this study experienced severe engorgement for one to three days and at least moderate engorgement for up to five days. The experimental group extracted milk for a mean of five days to maintain comfort, which is consistent with the length of time of moderate discomfort for the control group.

The investigator expected to collect data for no more than three days after the onset of engorgement of each subject. Initial data collection took at least six days per patient. Most patients required 10-12 days. One woman had not returned to pre-engorgement readings at the sixteenth postpartum day although her subjective symptoms had subsided.

Mechanical Removal of Milk

The women in the experimental group were asked to remove milk as often as necessary to maintain comfort. As this method had not been investigated before, it was not known how often or how much would be necessary. It was not known at what point lactation would be stimulated. All subjective scales were set so that an index of 2 would be moderate. For discomfort, an index of 2 was bearable, while an index of 3 was unbearable. It seemed reasonable to avoid a discomfort

index of 3 where most likely there would be sufficient engorgement to cause tissue edema and obstruction of the milk ducts. A tentative goal for an index of 2 was suggested by the investigator, to be adjusted to the woman's own desires and needs for comfort. As it happened, often the women found that they preferred an index of 1.0-1.5. They all reported that their last one or two milk extractions were not really necessary, but felt good.

Milk removal frequently necessary to maintain comfort differed from what was expected. The investigator anticipated that removal three times at the peak of engorgement would suffice. The total number of times the women removed milk had a range of 9 to 14 with a mean of 12.5 (Table 8). The daily average at the onset was 3-4 times with the frequency diminishing with the decline of engorgement. Although the women removed as much as 40 cc of milk per breast, the usual amount extracted was 15-20 cc per breast per pumping. The quantity removed also tapered off with the declining of engorgement. The time expended was about 5-10 minutes for pumping both breasts.

Table 8

Frequency That Milk Was Extracted with a Breast Pump
to Maintain Comfort by the Experimental Group

	Postpartum Day							Total
	3	4	5	6	7	8	9	
Patient # 1	4	3	4	2	0	1		14
Patient # 2	2	4	1	2	1	2	1	13
Patient # 3		3	4	2	3	2		14
Patient # 4	7	2						9

The first subject to use the experimental method had great success and was extremely enthusiastic about milk removal as a way of maintaining comfort. The second woman extracted 1-2 cc from each breast. When she experienced higher pressure readings and a large amount of leaking, the investigator suggested that she remove more milk (20 cc) as the first woman had done. This resulted in greater comfort and markedly less leaking, which she had found to be distressing.

It had been the investigator's intent not to interfere with the number of times for extraction, the amount of milk removed, or pass judgments on comfort. Following the experiences of the first two subjects the decision was made to suggest a similar pattern to future participants.

The women in the experimental group reported that they were pleased with the method. Three had experienced engorgement with previous pregnancies and could compare comfort. Three of the four women reported that the first extraction was uncomfortable and a little difficult. However, the second experience was easier, more comfortable, and they had no further problems. Asked whether they would use the method again, two women responded affirmatively. The other two women expressed a desire to breastfeed the next infants.

The involutorial period was shorter than that of the control group. This was probably due to the removal of the milk that was being produced by the pre-existing prolactin; the milk from the experimental group did not have to be reabsorbed by the breasts.

Limitations

This study may have been affected by the following limitations:

1. Subjective ratings may have varied between subjects due to individual perceptions of symptoms of engorgement.
2. Preconceived ideas and feelings may have affected the subjects' perceptions of the symptoms of engorgement.
3. Emotional effects of the suppression of lactation have not been considered.
4. There was a small sample population due to a limitation of time and available prospective subjects.
5. It appears that little is known about the course of engorgement. The available parameters did not accurately predict actual lengths or severity of engorgement for this sample.
6. Investigator bias was introduced. As this method had not been previously investigated, the number of times to remove milk, how much should be extracted, or what would stimulate lactation was not known. As observations increased, the investigator became more comfortable in advising expectations to the subjects. This resulted in extremely irregular courses of treatment within the group.
7. Some high pressure readings obtained in the control group were not reproducible, and measurements were deferred when engorgement was severe. Pressure from the instrument often forced milk from the nipples and indentations in the skin would often be persistent. Therefore, first readings had to be taken at face value and could not be verified. Higher readings may not be accurate due to the hesitation of the investigator to force the disk of the instrument 1 cm. into the breast before beginning the readings.

Lower readings were reproducible with pressures below a measurement of 3.5.

Implications for Nursing

This study has provided several ways to help the mother adapt to postpartum breast engorgement. The nurse will be better able to gather data to assess and define the problem. There will be an effective alternate approach to promote the mother's adaptation to engorgement and discomfort. Implications to assist in this adaptation are as follows:

1. There is an indication that a large number of women do not experience distressing amounts of postpartum breast engorgement.

These women will remain comfortable with the only intervention being the wearing of a supportive bra. Women need this information when making an informed decision about lactation suppressants.

2. Women need to be informed about the possible course of engorgement. A woman who expects the discomfort to last only a day or two will be greatly distressed and experience not only physical pain but mental fatigue and discouragement at a time that is already a crisis situation with the adjustment to a new baby. These women need to know the range of onset of engorgement and the length of time that it could persist.

3. Women need to have a plan of action should engorgement occur. Breast pumping is an effective and easy way, with no side effects, to remain comfortable.

4. It is indicated that a woman can feel the beginning of hardness and discomfort; she can then institute her plan of action before

her discomfort becomes acute. In this way she will have time to become familiar with the operation of the breast pump.

5. Postpartum women need to be advised that they will probably need to wear a supportive bra for at least three weeks to maintain comfort. Two women in the sample who do not usually wear bras removed them for a short period of time and put them back on due to increased discomfort and leaking.

Recommendations for Further Study

Several recommendations are made to improve the methodology and to indicate areas needing further investigation:

1. The findings of this study need to be validated with a larger sample.
2. Because of the time factor of numerous home visits this study should be conducted by a team. Fatigue and burn-out are realistic concerns.
3. To replicate this study, a different scale needs to be developed for leaking. The investigator did not consider the extensive use of breast pads. The amount of leaking is difficult to estimate when it is sporadic and dried on pads.
4. Hardness measured by the subjects is not a consistent measurement of breast engorgement. Trained observers with a high interrater reliability would be more accurate clinically. Pressure readings may then be more consistently correlated with objective hardness using a scale such as that developed by Newton & Newton (1951) when investigating the course of engorgement.

5. For severe engorgement, using a smaller disk size at less depth with the pressure gauge may give accurate readings without increasing breast discomfort or tissue edema (suggested in personal conversation with Salaman, 1980).

6. The course of postpartum engorgement needs to be further investigated and described.

7. The cheaper bell or bulb pump could be investigated as to its efficiency and practicality. The Loyd-B-Pump used in this study is effective and comfortable. However, it is expensive: the retail price is approximately \$50.00 and a rental fee at this time is \$8.00 per week. One woman in the experimental group tried an Even-Flo pump once and reported it to be tedious and inefficient.

8. Manual expression could be investigated as an inexpensive method for milk extraction and which could be used by the women following future deliveries. The stimulation of the nipple and areola may be little enough and infrequent enough not to significantly affect lactation or involution.

9. A predictor for the extent of lactation engorgement may be developed. There was nothing found in the literature reviewed to indicate the correlation of predelivery prolactin and estrogen amounts to engorgement. If a simple blood test could be performed with other routine laboratory tests, excessive engorgement might be predicted and intervention anticipated and initiated.

CHAPTER VI

SUMMARY

The purpose of this study was to test the effectiveness of milk removal as a method of reducing the discomfort of postpartum breast engorgement in nonbreastfeeding women. It was proposed that removing a small amount of milk with a hand operated breast pump would result in greater comfort and fewer symptoms of engorgement for the mother. It was further suggested that the mechanical removal of milk would not stimulate lactation nor affect the normal course of postpartum breast involution.

One cause of engorgement is the presence of excess milk which produces compression and obstruction of the milk ducts and circulatory vessels resulting in stasis and tissue edema. The breastfed infant is weaned slowly so that the mother can avoid painful engorgement. This is accomplished by a gradual diminution of prolactin stimulation thus slowly decreasing production of milk.

The prolactin and oxytocin reflex arcs are initiated by stimulation of neural receptors in the nipple and areola. A breast pump produces a deep pressure stimulus within the breast where there are no neural receptors. It produces minimal stimulation of the nipple and areola.

Based on Roy's adaptation theory, it was proposed that removal of milk from the lactiferous sinuses using a breast pump would provide

relief from the discomfort in the breasts without stimulating lactation. In this way the nurse could help the mother adapt to the experience and offer a way to attenuate the symptoms of engorgement.

Criteria for the selection of subjects included nonbreastfeeding women whose infants were not less than 37 weeks gestation, who had regional, local, or no anesthesia; a normal spontaneous, low or mid forceps delivery of a single infant; and a willingness to participate in the study.

The 13 women selected for the sample were followed through the course of postpartum breast involution. No or minimal engorgement was experienced by 46% (6 of 13) of the total population. The control group who experienced moderate to severe engorgement (N = 3) was compared to the experimental group who developed sufficient discomfort from engorgement to seek relief using the breast pump (N = 4).

Subjective and objective data were collected. Symptoms of engorgement--hardness, discomfort, and leaking--were recorded on scales of 0-4 (none to severe). Measurements were carried out three times daily starting shortly after delivery and continuing until the symptoms of engorgement had subsided. The patients recorded all medications and treatments related to the breasts. Engorgement was measured using the Pressure Gauge P-101. This determined tissue resistance in the lactiferous sinuses. The subjects in the experimental group removed milk from their breasts using a hand operated breast pump as desired to maintain comfort. They recorded data regarding the procedure.

Although the sample is small, the results suggest that the mechanical removal of milk is an effective way to increase the

comfort and decrease the symptoms of engorgement for women who do not breastfeed their infants. None of the women in either group experienced rebound engorgement nor was there evidence to indicate a stimulation of lactation. The women in the experimental group took no analgesia nor used any other treatment for breast discomfort. They had a shorter, more comfortable course of breast involution than did the control group.

There were other findings not addressed by the research questions. 1) A general pattern of engorgement was described using the data collected from the control group. With a mean onset occurring the evening of the second postpartum day, severe engorgement was sustained for a mean of three days before a gradual decline and return to normal on the ninth postpartum day. 2) By correlating the objective measurements taken with the pressure gauge with clinical symptoms, it was possible to categorize breast engorgement according to severity.

APPENDIX A
LOYD-B-PUMP

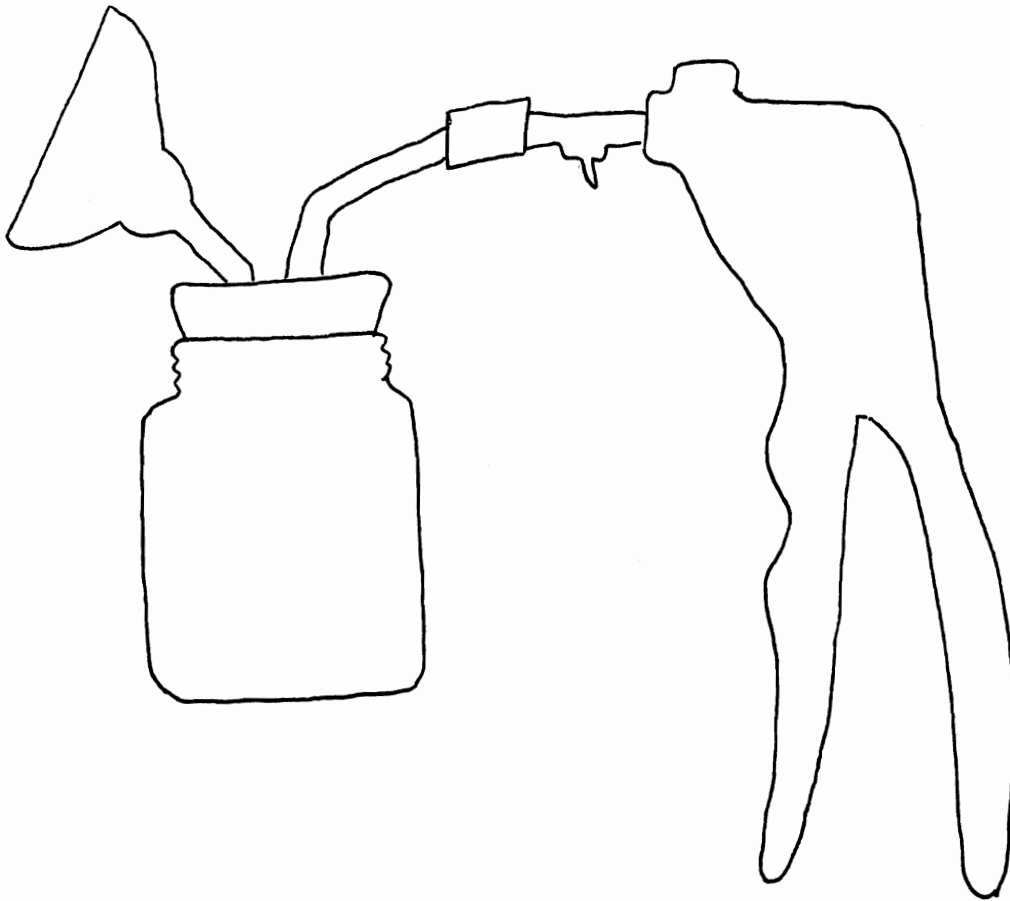


Figure 8. Sketch of Loyd-B-Pump breast pump. Not actual size.

APPENDIX B

DATA COLLECTION SHEETS

Demographic Data

Name _____ Age _____ ID# _____

Address _____ Phone _____

Physician _____ Parity _____

EDC _____ Delivery date _____

Problems during pregnancy

Type of delivery

Drugs during labor

Anesthesia

Complications of labor/delivery

Postpartum drugs ordered

Postpartum treatments ordered

Reason for withdrawing from the study

Data Collection Sheet Directions

Baseline data will be obtained prior to delivery. Data collection will begin within 12 hours of delivery and continued 3 times a day at approximately 0800, 1400, and 2000 until the pressure gauge readings return to predelivery measurements for 3 consecutive readings.

Pressure gauge readings: Readings will be taken in a semi-Fowler's position midline, 4 cm. above the nipple of each breast and entered into the appropriate spaces.

Subjective symptoms of engorgement: Enter into the appropriate spaces the severity of symptoms as reported by the woman on scales of 0-4. The scales are as follows:

Hardness:

- 0 = breasts are soft, that is, she feels no change from the normal consistency of breast tissues which are soft upon her palpation.
- 1 = breasts are slightly firm, that is, she can feel small areas of firmness which cannot be indented with her fingers with palpation.
- 2 = moderately firm, that is, she can feel large areas of firmness which cannot be indented with palpation.
- 3 = breasts very firm, that is, the total breast cannot be indented with palpation.
- 4 = breasts are hard and lumpy, that is, the breasts cannot be indented and she can feel knots and strings within her breasts.

Discomfort:

- 0 = comfortable, that is, she has no discomfort at all.
- 1 = slightly uncomfortable, that is, she feels tightness in her breasts.
- 2 = moderately uncomfortable, that is, she feels increased tightness in her breasts, but the discomfort is bearable.

- 3 = very uncomfortable, that is, she feels severe tightness in her breasts and needs analgesia or nursing measures which includes tight breast binding, cold packs, etc.
- 4 = extremely uncomfortable, that is, she feels severe tightness which is not relieved by analgesia and/or nursing measures.

Leaking:

- 0 = no leaking observed.
- 1 = a spot on clothing less than 2.5 cm. in diameter.
- 2 = a spot larger than 2.5 cm. but less than 7 cm. in diameter.
- 3 = a spot larger than 7 cm. in diameter with occasional dripping from the nipple.
- 4 = constant dripping from the nipple.

Data Collection

Patient ID# _____

Day	AP	Delivery Day	1		2		3		4		5		6		7		Time	2 wk	3 wk	4 wk	
			R	L	R	L	R	L	R	L	R	L	R	L	R	L					
Pressure Gauge Reading	R	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	0600	/	/	/
	L																	1400			
Hardness of Breasts 0-4																		0600			
																		1400			
																		2200			
Discomfort 0-4																		0600			
																		1400			
Leaking 0-4																		0600			
																		1400			
																		2200			

R = right breast

L = left breast

AP = antepartum

Patient ID# _____

Milk Removal Record

When you are uncomfortable from engorgement in your breasts and need relief, before you take a "pain pill" please call for the study director. She will help you to extract some milk from your breasts using a hand operated breast pump. Pressure readings will be recorded before and after the removal of milk. You will also be asked to rate the amount of discomfort that you are experiencing on a scale of 0-4 and whether or not you obtain relief from the removal of milk. If relief is not obtained, then take your "pain pill" or have ice packs applied. Try to have the milk removed before you are very uncomfortable.

Date	Time	Discomfort 0-4	Amount of Milk		Discomfort 0-4	Remarks
			R	L		
Example: Nov 2	2:30 pm	3	6.5	7.2	1	Milk removed without difficulty

R = Right breast

L = Left breast

Follow-up Questionnaire

The following questions will be asked at 2, 3, and 4 weeks postpartum by telephone interview. The same scales of 0-4 will be used to indicate the subjective symptoms of engorgement as were used for the initial data collection, and will be reviewed with the patient before each question.

1. Using the same scale (0-4) as we used previously, in the last week, have you experienced any discomfort with breast engorgement?

0 1 2 3 4

2. Using the same scale (0-4) as we used previously, in the last week, have you experienced any hardness of your breasts?

0 1 2 3 4

3. Using the same scale (0-4) as we used previously, in the last week, have you experienced any leaking of milk from your nipples?

0 1 2 3 4

4. If you answered anything but 0 to any of the questions, what did you do for relief?

APPENDIX C

PRESSURE GAUGE INSTRUMENT

The following is an excerpt from Geissler (1967) describing the purpose, principle and operation of the pressure gauge model P-101:

Purpose. The pressure gauge was designed to measure cumulative pressure at a specified distance below a surface. The initial application consisted of determining the force at a prescribed depth below the skin.

Principle. The principle of operation basically consists of determining the holding force of an electromagnet. When a current is supplied to a coil, a magnetic field is generated which exerts force on a conductor placed in the center of the coil. The amount of force is proportional to the applied current. In this instrument, the coil is energized and the core conductor is thereby held against a plug which has been inserted into the coil. If a specific force is applied to the core conductor the energizing current may be reduced to the point where the force due to the magnetic field is equal to that applied to the core (arising from the tissue). If the current is reduced slightly more, the core will be released from the plug. The current at this time is proportional to the applied force (pressure coming from the tissue).

Operation. In operation, sufficient current is supplied to hold the plastic disk in the extended position. The disk is then screwed in or out to the desired depth. To obtain a measurement, the disk is kept in the extended position and pressed into the tissue up to the desired depth as indicated by a plastic plate being flush with the surface. The current is then reduced by a control, thereby reducing the force to a value equal to that exerted by the substance being measured. At this point, the disk will release and return to its neutral position. The dial reading at the point of release is proportional to the applied force (force from the tissue) (pp. 131-132).

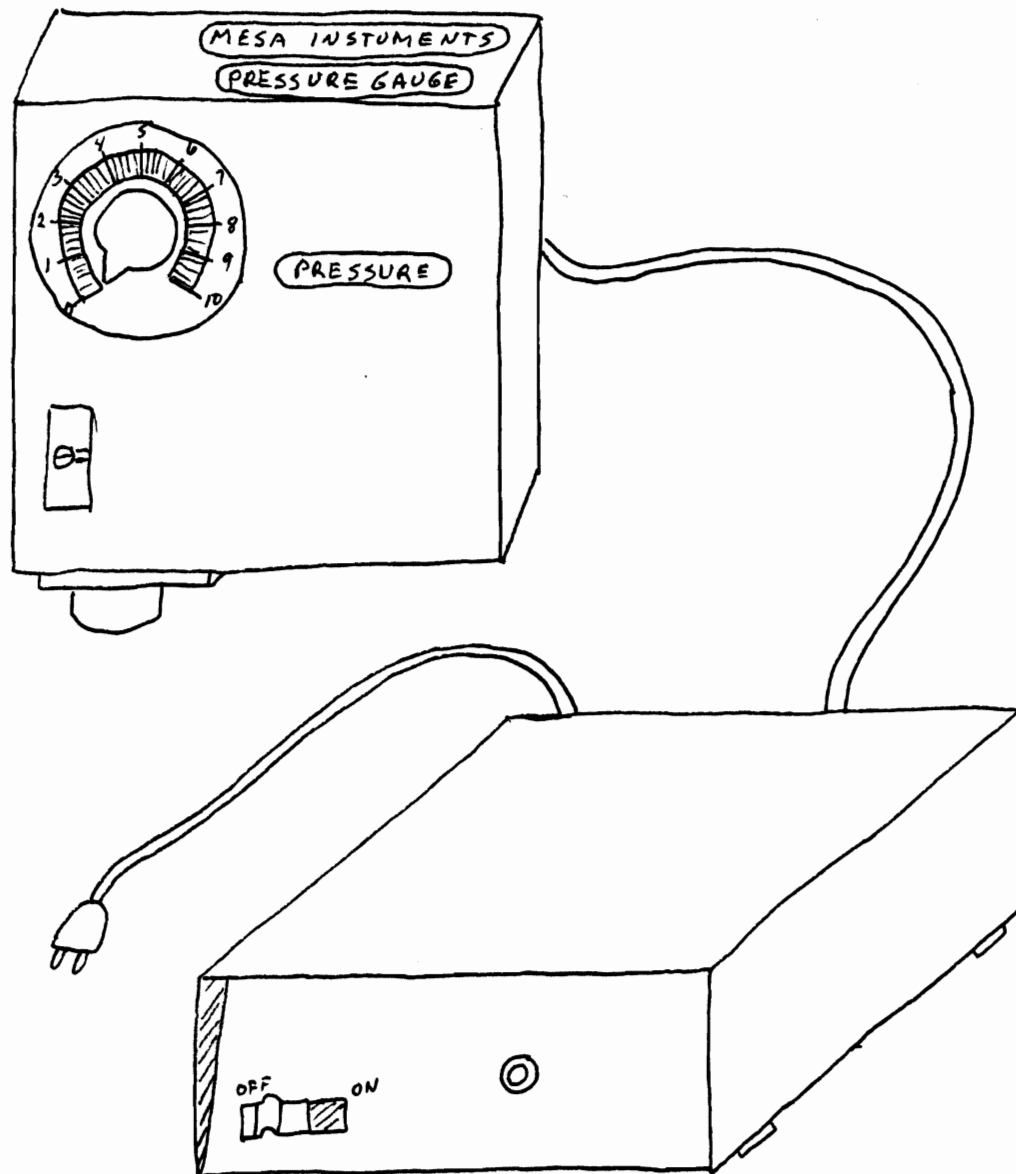


Figure 9. Drawing of the pressure gauge and power supply. Not actual size.

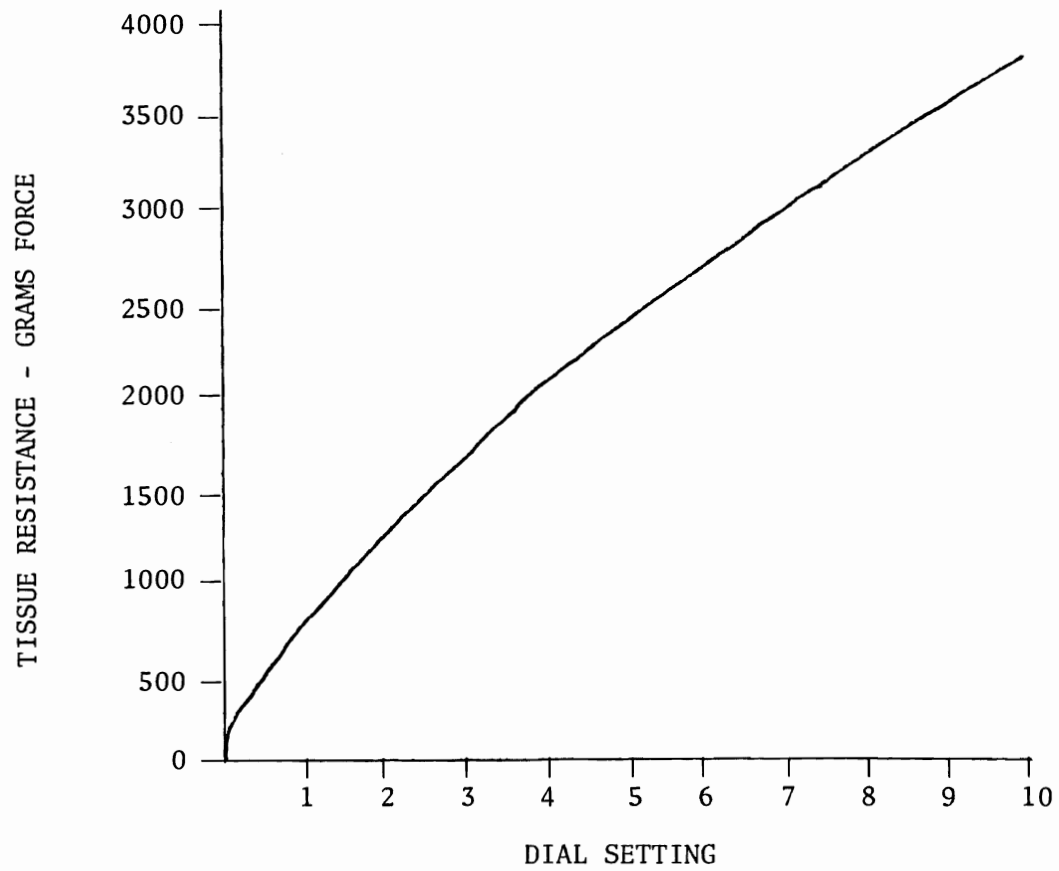


Figure 10. Relationship of dial setting of the pressure gauge model P-101 to tissue resistance in grams. (Courtesy of Roger Salaman)

APPENDIX D

INFORMATION LETTERS

Control Group Information Sheet

This study is being conducted by Yvonne Meserve, R.N., a candidate for the Master of Science degree at the College of Nursing, University of Utah. This study will investigate factors that help to relieve breast engorgement in nonbreastfeeding women following birth.

The engorgement that each woman may experience may vary from none at all to severe. Symptoms, should they occur, usually last from 24 to 48 hours, and the discomfort is usually treated by wearing a supportive bra, ice packs, and medication for relief of pain or discomfort. Any women who participate in this study will receive the same routine postpartum care provided for all patients. If discomfort of breast engorgement should be experienced, she will receive the normal counseling and medications for relief.

At eight hour intervals, the investigator will visit you and ask you to rate the symptoms of engorgement that you are experiencing such as hardness, leaking or discomfort. Pressure readings will be taken at this time. This procedure will be demonstrated by the investigator.

You will be asked to keep a record on the charts provided of the following:

1. Any medication that you take and the reasons that it was taken. If it is for pain or discomfort, the location of the pain and whether or not you experienced relief.

2. Any treatments that are breast related such as ice packs or bindings.

In the event that any breast engorgement that you have experienced has not resolved, the study investigator will come to your home to take the pressure readings. This will be at a time that is most convenient for you.

After you have been home for 2, 3 and 4 weeks after the birth of your baby you will be contacted at your home by telephone by the investigator to ascertain whether or not symptoms of engorgement have reoccurred.

Experimental Group Information SheetProcedures

This study is being conducted by Yvonne Meserve, R.N., a candidate for the Master of Science degree at the College of Nursing, University of Utah. This study will investigate the effectiveness of a method of relieving breast engorgement in nonbreastfeeding women following birth.

The engorgement that each woman may experience may vary from none at all to severe. Symptoms from engorgement usually last from 24 to 48 hours. The discomfort is usually treated by wearing a supportive bra, ice packs, and medication for the relief of pain. In this study participants will be asked to extract a small amount of milk using a hand operated breast pump until the breasts feel comfortable. Participants in the study will receive the same routine postpartum care that is provided for all patients. If discomfort of breast engorgement is experienced, she will receive the normal counseling and medications for relief.

At eight hour intervals, the investigator will visit you and ask you to rate the symptoms of engorgement that you are experiencing such as hardness, leaking, or discomfort. Pressure reading will be taken at this time. This procedure will be demonstrated by the investigator.

You will be asked to keep a record on the charts provided of the following:

1. Any medication that you take and the reasons that it was taken. If it is for pain or discomfort, the location of the pain and whether or not you experienced relief.

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In the event that any breast engorgement that you have experienced has not resolved, the study investigator will come to your home to take the pressure readings. This will be at a time that is most convenient for you.

After you have been home for 2, 3, and 4 weeks after the birth of your baby you will be contacted at your home by telephone by the investigator to ascertain whether or not symptoms of engorgement have reoccurred.

Process of Lactation

There are some things known about the process of lactation. Milk production lasts 2-3 weeks regardless of the measures employed to suppress it. However, you do not usually experience symptoms of engorgement for more than 1-2 days. Milk production is a process by which the supply meets the demand. Removing too much milk will stimulate the breasts to make more while the presence of milk in the tiny milk-producing glands inhibits the production of milk. With severe engorgement, the swelling of the breast tissues can block the milk ducts and the milk cannot be removed. Therefore, it is important not to remove more milk than is necessary to achieve comfort, and not to wait until your breasts are hard and uncomfortable to do it.

The studies that have been reviewed by the investigator suggest that using a breast pump produces pressure deep inside the breast but does not stimulate the nerves located in the nipple and alveoli that regulate the hormones that stimulate lactation. Removal of milk from the large milk ducts just behind the nipple should not stimulate milk production, but it is possible that your milk supply may be slightly stimulated by the extraction of the milk. Therefore, you may experience the presence of milk longer than if you follow the standard regime for the relief of breast engorgement. However, your breasts should be more comfortable during this time, which is the purpose and goal of this study.

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