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Procedural burn pain intensity and its covariates, under conditions of varying physical control by the patient during the dressing change

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PROCEDURAL BURN PAIN INTENSITY AND ITS COVARIATES, UNDER CONDITIONS OF VARYING PHYSICAL CONTROL BY THE PATIENT DURING THE DRESSING CHANGE

by

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DISSERTATION

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DOCTOR OF PHILOSOPHY

in

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Dedication

I dedicate this dissertation to my family, friends and patients.

I have come to realize that outlook in life is determined by a combination of genetics and early upbringing. Whatever the balance of these factors, a sunny disposition and a positive outlook emanate from our families, not ourselves. My thanks to my grandparents, parents, sister, brother, and aunts for cheer, humor and optimism.

Sheer enjoyment is rooted in the present, in our daily encounters with family and friends. My thanks to my husband, my children and my friends for the enjoyment of today, and for showing me that there are myriad ways to view the world, none of them true, all of them real and important. Peter Sutherland, my youngest child, who is 24 years old, deaf, mentally retarded and autistic, lives at home with my husband Jerry and me. I learn a lot from Peter.

Forced change molds us, causing growth, freedom, surrender, bitterness or wisdom, as the inevitable disappointments and terrors of existence are modified by disposition and outlook, and by our daily encounters with those who care about us. I have learned about forced change from patients who have endured terror and pain and become molded into different individuals, often against their wishes and despite their efforts to remain the people they were. Change is splinteringly painful. It works against natural inertia, counter to trepidation. My thanks to the ten subjects who allowed me to study their physical pain and their "life pain," and to study them in quite a bit of detail. They are very special, and I have learned from them that there is elegance and dignity in even small efforts to endure.

Preface

During orientation to the Burn Unit at University of California Davis Medical Center (UCDMC), I heard nurses tell patients, "Wash your own burns. It's less painful if you wash them yourself." I discovered first clinically, and now experimentally, that this is true.

One does not complete a doctorate alone. I must acknowledge many people's assistance. My advisor and mentor, Dr. Marilyn Savedra, has been the soul of tact, courtesy and wisdom, always supportive and patient, for my four years of graduate school. Dr. Christine Miaskowski provided valuable assistance in editing the paper that became the first half of Chapter 2. Dr. Miaskowski, Dr. Ida Martinson, Dr. Robert Slaughter and Dr. DeLois Weekes graciously served on my committees. Mary Tesler provided continuing encouragement and, better yet, comprehension of my indirect way of learning and examining life, in general. The nurses and ward secretaries at UCDMC helped me to identify potential research subjects, and the day shift nurses simplified data-collection by their flexibility. Margie Crandall, a nurse at UCDMC and doctoral student at UCSF, served as the second rater for coding the qualitative portion of the study. Susan Proctor commuted with me from Sacramento to UCSF for our first and third years in the doctoral program, sharing deplorable cafeteria food, Xeroxes, and The Quake of '89 in the quad. Helen Higby commuted with us our first year and made up one-third of the famous "car seminar." Brenda Hanson-Smith commuted with us our third year and, as a lower classman, reminded us of what we had survived. Jerry Sutherland put up with a lot.

PROCEDURAL BURN PAIN INTENSITY AND ITS COVARIATES, UNDER CONDITIONS OF VARYING PHYSICAL CONTROL BY THE PATIENT DURING THE DRESSING CHANGE

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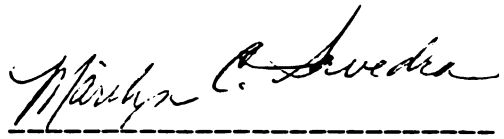
Abstract

For the 120,000 Americans hospitalized with burn injury yearly, standard care consists of periodic washing, debridement and redressing of their wounds, characterized by patients as moderately to excruciatingly painful. Because clinical and research data indicate that patient-performed washing (PPW) during the burn dressing change may be less painful than nurse-performed washing (NPW), a study using a single-subject repeated reversal design was implemented in which numerical pain intensity scores were obtained intraprocedurally under conditions of both PPW and NPW, for ten adult subjects with burns. Measurements of retrospective pain quality, health locus of control, mood state, adequacy of washing and quantity of medication administered were also obtained. Interviews with subjects provided qualitative data and subject preference of PPW versus NPW.

For all ten subjects, pain was significantly less intense under conditions of PPW, as compared with NPW, by repeated-measures ANOVA with secondary Scheffé analysis ($p < .001$ through $p < .05$). Adequacy of washing, as evaluated by blind raters, and opioid medication administration did not differ significantly between PPW and NPW ($p < .05$). Descriptors selected by subjects characterized

procedural pain in general as exhausting, stinging, sharp, tender and piercing in quality, PPW pain as exhausting, jumping and tender, and NPW pain as stinging, exhausting, piercing, shooting, sharp, wrenching, searing, hurting, sickening, fearful and tearing.

Seven subjects preferred PPW. Two preferred NPW, and one indicated a divided preference. Statistically, subject preference of PPW over NPW most clearly associated with the number of times the subject performed NPW, with an internal health locus of control, with a more negative score on the vigor-activity subscale of the POMS and with a low score on the evaluative subscale of the McGill Pain Questionnaire. Reasons given by subjects for preferring NPW were doubts of their own expertise, compression of legs in stretching to wash calf burns, and inability to self-inflict severe pain. Reasons given by subjects for preference of PPW were decreased pain and enhanced feelings of control.



Marilyn C. Savedra, RN, DNS, Chair

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CHAPTER I

THE STUDY PROBLEM

Introduction to the Problem

Pain has been, and continues to be, a major problem for the hospitalized burn patient (Fagerhaugh, 1974; Perry, Heidrich & Ramos, 1981). Over the past twenty years, however, the focus of burn research has been upon four broad areas: surgical intervention (grafting, scar revision, timing of excision), enhancement of function (physical therapy, pressure garments, splinting), epidemiology (incidence of and predictive factors in mortality and morbidity with burn injury) and minimization of infection (early grafting, isolation, topical antimicrobials, nutrition). Research has not focused as extensively upon relief of pain for the hospitalized burn patient.

Pain within a burn unit is inevitable (Fagerhaugh, 1974) and a certain amount of pain must be regarded as a given by patient, nurses, physical and occupational therapists and physicians. Nonetheless, awareness of burn pain's inevitability does not make it more bearable for the patient.

Historically, investigation in the area of burn pain has been ongoing but does not constitute an integrated body of research. Various researchers have conducted short series of studies focused upon description of burn pain intensity (Heidrich, Perry & Amand, 1981; Perry, 1984a; Perry, 1984b; Perry & Heidrich, 1982; Perry et al., 1981), the psychosocial results of learned helplessness in the pediatric burn patient (Kavanagh, 1983a; Kavanagh, 1983b; Kavanagh et al., 1991), the use of hypnosis during dressing changes

(Everett, Patterson, Montgomery, Honari & Heimbach, 1993; Patterson, Everett, Burns & Marvin, 1992; Patterson, Questad & Boltwood, 1987; Patterson, Questad & de Lateur, 1989) and pharmacological interventions for the pediatric burn patient in pain (Atchison, Osgood, Carr & Szyfelbein, 1991; Osgood & Szyfelbein, 1989; Osgood & Szyfelbein, 1990). Many research studies are isolated demonstrations of efficacy of an intervention or debunkings of formerly-credited interventions. Other than for refutation, researchers in burn pain have not used others' work as a basis for their own, creating independent research tracks rather than building upon evidence already amassed. Publication of results of research in burn pain is concentrated, to a degree, in the two major burn journals, Burns, Including Thermal Injury and Journal of Burn Care and Rehabilitation, but over the past ten years less than half of the published research concerning burn pain has appeared in these journals. Thus, research in burn pain is diffuse and often difficult to find. Research concerning strategies for reduction of procedural burn pain intensity is sparse, despite patients' identification of pain as a major concern during burn hospitalization and their description of pain as being severe only during procedures such as dressing changes and vigorous physical therapy (Perry et al., 1981). Reflecting nursing's identification of pain as an area of continuing concern, the burn nursing Delphi survey of 1991 (Marvin et al.) identified pain as a high-priority area for nursing research.

Burn patients' pain incorporates both baseline and procedural components (Perry et al., 1981). Baseline pain at rest is described by

burn patients as none to moderate, whereas procedural pain is described most often as severe to excruciating (Perry et al., 1981), as procedural pain is superimposed upon baseline pain.

Research examining strategies for burn pain control has addressed patients' reported pain or has estimated their pain by observation of behaviors. In studies of reported burn pain, measurements and descriptions have been either concurrently or retrospectively obtained. Both reported and observed burn pain has been scrutinized at one of three points in time: procedurally, immediately post-procedurally, or at baseline. The overall intensity and quality of pain in a twenty-four hour period has also been addressed. So there are a number of perspectives from which to capture burn pain intensity and quality. Because burn patients identify the dressing change as the most painful experience of their treatment (Perry et al., 1981), it is essential to focus upon procedural pain and strategies effective in reducing its intensity. Reported, concurrently-obtained ratings of pain intensity are likely to provide the most accurate estimate of procedural burn pain intensity.

It may be that for individual patients, burn injury represents the most negative experience they have yet encountered in their lives (Sutherland, 1988) and the most painful. Consequently, on an intensity scale from 0 to 10, the pain of burn injury and treatment may be the sole representative of the "10" designation. It follows, then, that implementation of an effective intervention that decreases procedural pain may <u>still</u> yield a life experience that represents "10" for patients having free access to that particular intervention during

their entire burn hospitalization. The intensity of the pain experience has been diminished from what it might have been, but patients will not know it: their "10" may represent what would have been an "8" or a "9" under non-intervention conditions but they are unaware of the benefit they have accrued.

This is the basis of real altruism. The source of the benefit, and even the existence of the benefit, is unrecognized.

Statement of the Problem

Treatment of procedural burn pain intensity is multifaceted. Reliance upon opioids and anxiolytics is common practice (Perry et al., 1981), and concurrent use of cognitive interventions, such as stress inoculation in both children (Elliott & Olson, 1983) and adults (Wernick, Jaremko & Taylor, 1981), hypnosis (Wakeman & Kaplan, 1978), or distraction (Kelley, Jarvie, Middlebrook, McNeer & Drabman, 1984), has been supported by research.

The efficacy of the intervention of encouraging patient-performed washing during children's dressing changes for reducing pain behaviors is also supported (Kavanagh, 1983b; Kavanagh et al., 1991; Tarnowski, McGrath, Calhoun & Drabman, 1987). Despite clinical support (Wagner, 1984), there is no published research examining the effect of provision of physical control to adult burn patients during the dressing change, and no published research with adults or children examines the effect of provision of physical control to the patient during the dressing change, as measured by concurrently-obtained perceived pain intensity scores.

Specific Aims of the Study

There were eight specific aims. They were to:

1. Determine if the condition of allowing burn patients to perform their own washing during the dressing change (PPW), rather than having the washing performed by burn nurses (NPW), has an effect upon perceived pain intensity.
2. Determine whether there is a different amount of pain medication administered under conditions of PPW versus NPW.
3. Describe the quality of burn pain under conditions of PPW and of NPW.
4. Determine patient preference of PPW versus NPW, as reported at the end of subjects' participation in the study.
5. Determine patient opinion of which method(s) would be most efficacious for other burn patients.
6. Describe the nature of procedural burn pain as it relates to PPW and NPW.
7. Determine whether patients wash their burns as thoroughly as do burn nurses.
8. Determine if locus of control, mood state or any demographic variable appears to be related to individual differences in pain intensity, pain quality or patient preference.

Significance

Approximately 120,000 Americans are hospitalized for burn injury yearly (Dennis Driscoll, personal communication, October 1991). Standard burn care consists of once- to thrice-daily washing, debridement and redressing, characterized by patients as moderately to excruciatingly painful (Perry et al., 1981). Burn patients report that the intensity of their pain far exceeds anything previously experienced (Fagerhaugh, 1974).

Routine burn care is performed by nurses, or by tubroom personnel trained and supervised by nurses, in burn units throughout the United States. Nurses have access to patients during dressing changes, they administer medications to modulate pain, and they assist patients in the use of various cognitive strategies and techniques that purport to reduce pain intensity both during and between dressing changes. Despite medication administration and use of cognitive strategies, patients still experience pain during dressing changes. Any effective strategy for reducing procedural pain intensity is worthy of serious investigation.

Research Questions

Research questions emanating from study aims were three, including six corollaries:

1. Is there a difference in burn patients' pain when PPW and NPW are compared?

    A-1. Is there a difference in pain intensity?

    A-2. Does the amount of pain medication administered differ on PPW versus NPW days?

B. Is there a difference in pain quality?

C. Which method do patients prefer and why?

D. Which method do subjects believe other patients should use and why?

E. What is the nature of dressing change pain as it relates to PPW and NPW?

2. Do burn patients cleanse their burns as thoroughly as do nurses?

3. If patients differ in their responses to PPW and NPW in terms of pain intensity, pain quality or patient preference, do these differences relate to locus of control, mood state or demographics?

Hypotheses. Three hypotheses, derived from questions 1-A-1, 1-C and 2, were made:

1. There will be a significant difference in pain intensity under conditions of PPW and NPW, and PPW will be less painful.

2. If burn patients show a significant difference in pain intensity, with PPW less painful than NPW, they will prefer PPW.

3. Burn patients will wash their burns as thoroughly under PPW conditions as nurses wash patients' burns under NPW conditions.

Assumptions

Several assumptions were made related to burn patients, burn staff and the data-gathering process:

1. Patients report their pain intensity and quality honestly.

2. Patients are capable of quantifying their pain on a 0-to-10 numerical scale even when moderately sedated for the dressing change.

3. Patients are capable of selecting verbal descriptors that qualify dressing change pain when questioned during or immediately following the dressing change.

4. Burn nurses can function as blind raters without seeking out sub rosa information as to whether the patient or the nurse performed dressing change washing on a given day.

5. Burn nurses rate the effectiveness of burn washing and debridement honestly.

6. There are no hidden rewards for the patient that are contingent on positive or negative responses at any stage of data-collection.

Definition of key terms

Burn is the destruction or injury of at least the epidermal layer, and sometimes the dermis, by heat, friction, radiation or chemical.

Dressing change is the procedure performed one to three times daily in which dressings are removed and the burn wound cleansed, debrided and redressed. Cleansing of the burn wound may be performed by manual washing, by rinsing off over a tub, or by actual immersion and manual washing. For the purposes of this study, cleansing of the burn wound always involved manual washing.

Nurse-performed washing is washing of the burn wound performed by the nurse. It can include debridement, the removal of nonviable tissue, as well.

Patient-performed washing is washing of the burn wound performed by the patient. It can include debridement.

Limitations

The study is limited to the subjective reporting of burn patients regarding such private and personal information as pain intensity, pain quality, mood state, beliefs about health practices, personal preference and opinions. Although some factual data are partially verifiable, such as the probable association of pain scores of "10" with the patient screaming, crying or swearing, the bulk of the data gathered in the course of this study is not verifiable.

The sample is limited to ten burn patients who were injured severely enough to be hospitalized at a regional burn center. Because smaller and less severe burns are sometimes treated by hospitals without burn units, the sample is not necessarily representative of all hospitalized burn patients. The sample is limited to inpatients who received a total of four or more days of dressing changes, some of which provided research data. It is not known whether patients hospitalized for fewer than four days exhibit similar responses to dressing changes.

CHAPTER II

REVIEW OF THE LITERATURE

Theoretical Overview of Burn Pain

Pain Mechanisms

ction of the sensation of pain. The subjective sensation of ated with injury is dependent upon several sequential ogic events. Transduction, literally a "leading across," is whereby information related to tissue damage or is converted to electrical energy, the sole medium by nervous system relays information (Sudarsky, 1990). It is hat small-diameter primary afferent nociceptors may be y direct pressure, by chemical mediators and/or by neuroreceptors' conversion of pressure, touch and heat ity (Fields, 1987; Kruk & Pycock, 1991). Chemical such as potassium and histamine, may be released by destroyed cells, or mediators may be indirectly produced s cell damage provides substrates for subsequent conversion to mediators (Fields, 1987).

ation of peripheral small-fiber nociceptive afferents ransmission of noxious impulses to the dorsal root e location of cell bodies for peripheral afferents 1990). Both the number of small-fiber afferents nd the frequency of discharge contribute to pain intensity. sal root ganglion, primary nociceptive afferents synapse tory interneurons and second-order projection neurons Levine, 1984). Chemical mediators at the synapse may be

acetylcholine, substance P (a neuropeptide released by unmyelinated afferents), somatostatin, gamma aminobutyric acid, glutamic acid and aspartic acid, possibly acting alone and possibly acting in concert as co-mediators (Kruk & Pycock, 1991). After synapsing, the pain stimulus ascends via the spinothalamic or the spinoreticulothalamic tract to cortical centers, producing an initial sensation of pain (Fields, 1990).

Modulation of the pain impulse. Modulation of the pain signal can occur in at least two ways. As large-diameter primary afferents are stimulated, they, in turn, contribute to inhibition or diminution of the pain signal by activation of inhibitory interneurons, affecting both quality and intensity of pain (Fields & Levine, 1984). A second method of modulation of the noxious signal, descending control, occurs through activation of neurons extending from cortical areas such as the midbrain periaqueductal gray (PAG) (Fields & Basbaum, 1978) and the rostral ventromedial medulla (RVM), to the dorsal horn (Fields, 1990; Fields & Levine, 1984). Activation of PAG and RVM neurons results in release of endogenous opioids (Fields & Basbaum, 1978), which are chemical modulators of the pain impulse; stimulation of brain areas rich in endogenous opioid peptides produces analgesia (Fields & Basbaum, 1978). Other means of modulation, such as sensory neurons extending from the dorsal horn to the periphery, and acting directly upon nociceptors, may exist, as well. Since the normal sequence of events in injury seems to produce endogenous endorphins, then it appears clear that this descending control modulating pathway can produce diminution of

perceived pain (Fields, 1987). Augmentation of perceived pain may occur when PAG and RVM neurons cease to be stimulated and endogenous opioid peptide levels decline. States of anxiety or distraction can augment or decrease perceived pain (Fields, 1990; Wall, 1979). Additionally, strategies termed cognitive, such as hypnosis, relaxation therapy and biofeedback, may produce modulation of perceived pain through descending pathways, as well (Fields & Levine, 1984).

Perception of pain. Nociceptive signals are relayed to the cortex, resulting in cognitive processing of pain, described by Melzack and Casey (1968) as having sensory-discriminative and affective-motivational components. Although the sensory-discriminative component of pain does not vary appreciably interindividually, or intraindividually, the affective-motivational aspect of pain perception produces wide variations in pain perception from individual to individual and even from experience to experience, within the same individual. Type of pain, previous experience with pain, location and intensity of pain, projected likelihood of pain duration and expected trajectory of the painful situation all lend variability to the way pain is perceived and the way it is endured. Evidently, the frontal lobe plays a major role in the affective-motivational, or suffering, aspect of pain (Fields, 1987).

Summation and neuroplasticity. Additional concepts important in understanding pain transmission are summation and neuroplasticity. Temporal summation is the neurologic event that can occur if a second synaptic potential occurs before the first has

decayed (Atwood & MacKay, 1989). Rapidity of stimulation to a nociceptor can consequently cause firing, even when the second stimulation applied by itself at another time would have been insufficient to cause firing. Similarly, spatial summation occurs if small impulses arrive along two or more inputs, combining in effect to generate depolarization (Atwood & MacKay, 1989).

Neuroplasticity is a collective term for the modifiability of the nervous system (Milgram, MacLeod & Petit, 1987). The three kinds of neuroplasticity are developmental, anatomical and physiological. Physiological plasticity represents a change in the pattern of activation, the neuronal firing threshold or the level of synaptic responsiveness (Milgram et al., 1987). It is not clear whether physiological plasticity implies neuroanatomical changes or whether it is solely a process of chemical mediation; however, in animal studies, subcellular changes in learning have been demonstrated to be both cell-specific and chemical in nature (Coulter, Disterhoft, Bank & Alkon, 1987).

Plasticity of sensory function in the spinal cord represents intraindividual variation in response to pain at differing points in time (Zimmermann, 1986), possibly resulting from differing concentrations of intracellular chemical mediators, as new patterns of activation are created. Because a concentration of chemical mediators can persist for minutes or hours (Coulter et al., 1987), favoring continued neuronal discharge, it is possible that pain experienced in an ongoing pain state represents not current pain but pain experienced within the past moments, hours or days.

Pain Mechanisms in Burn Injury

Production of the sensation of burn pain. The subjective sensation of pain in burn injury depends upon the same neurophysiologic events that any pain sensation derives from, but it also includes several aspects peculiar to burns (LaMotte, 1984). Transduction begins when C-polymodal nociceptors and various A-fiber nociceptors are activated by chemical mediators, such as intracellular potassium, histamine, bradykinin and prostaglandins, released by damage to, or destruction of, burned cells (Beitel & Dubner, 1976; LaMotte, 1984; Martyn, 1986). Activation of peripheral afferent nociceptors results in transmission to the dorsal root ganglion. As in any painful injury, the magnitude of intensity of the painful sensation depends upon the number of nociceptors activated, which represents the area and depth of the burn. But pain of burns also may be augmented by both temporal and spatial summation (LaMotte, 1984), increasing transmission of impulses to cortical centers, with resultant hyperalgesia. In burn injury, afferents which are damaged, as opposed to destroyed, continue to be continuously reactivated, both spontaneously and by small changes in position of burned areas, producing ongoing pain (Melzack & Wall, 1982). Also contributing to pain is the body's impaired perfusion of burned tissue, especially during the emergent phase of burn hospitalization (Martyn, 1986). Perfusion impairment can result in a lengthened period of time for changes in extracellular ionic concentration, resulting in burned areas' retention of elevated amounts of chemical mediators for extended periods. Additionally,

pain continues to worsen over the course of hospitalization, possibly partially due to physiologic neuroplasticity, but possibly due to return of normal sensation to formerly analgesic areas through healing of damaged nerve tissue (Savedra, 1976), or to decreased tolerance for pain related to the fatigue associated with disrupted sleep patterns and frequent dressing changes (Perry et al., 1981), or to a conditioned response of dread (Beales, 1983; Fagerhaugh, 1974; Kelley et al., 1984).

Modulation of the burn pain impulse. Modulation of burn pain presumably occurs through inhibitory interneurons and descending control mechanisms, as with pain in general (Fields & Levine, 1984). It is not known whether burn injury affects inhibitory interneuronal activation. However, descending control's intact mechanism after burn injury can be inferred from studies demonstrating effective modulation of burn pain by cognitive-behavioral interventions (Hammond, Keye & Grant, 1983; Kavanagh, 1983b; Kavanagh et al., 1991; Knudson-Cooper, 1981; Tarnowski et al., 1987; Wakeman & Kaplan, 1978; Wernick et al., 1981).

Perception of the sensation of burn pain. Perception of burn pain includes both sensory-discriminative and affective-motivational aspects (Choiniere, 1989). Life disruption, fear, anxiety and depression all may affect the burn patient's perception of pain (Andreasen, Noyes, Hartford, Brodland & Proctor, 1972; Beales, 1983; Choiniere, Melzack, Rondeau, Girard & Paquin, 1989; van der Does, 1989).

Characteristics of burn pain. Burn patients experience both baseline and procedural pain (Perry et al., 1981). Baseline pain is described by burn patients as relatively constant, contributing to total perceived pain but varying little in intensity, from moment to moment, and rated in intensity as none to moderate (Perry et al., 1981). Procedural burn pain represents an additive concept including both baseline pain and the pain resulting from therapeutic activities of nurses as they wash, debride, and redress wounds (Choiniere et al., 1989). Burn patients identify their dressing changes as being the most painful experiences of their hospitalization, rating their pain as severe to excruciating (Perry et al., 1981). This is consistent with what is known about pain sensation. Baseline pain is probably a product of nociceptive firing in response to elevated levels of chemical mediators in burned tissues, secondary to cell lysis, and of continued activity by viable nociceptors in response to subtle changes in patient position that create pressure and pulling of dressings. Procedural pain contributes additional nociceptive firing as often-adherent dressings are removed and the burn wound washed and redressed, possibly creating release of chemical mediators, as well. Additionally, as hospitalization lengthens, patients come to expect the burn dressing change to be painful (Beales, 1983; Perry et al., 1981), creating a situation of anxiety or dread which also may add to total perceived pain (Charlton, Klein, Gagliard & Heimbach, 1983; Wall, 1979).

Strategies for decreasing burn pain's intensity. Interventions designed to decrease the intensity of burn pain can be categorized by

neurologic level of effect. Strategies that decrease transmission of peripheral small-fiber nociceptor impulses include the use of analgesic topical ointments and creams, such as lidocaine (Brofeldt, Cornwell, Doherty, Batra & Gunther, 1989), and the use of alternative wound dressings that decrease or obviate the need for dressing changes, such as Biobrane (Phillips et al., 1989). Strategies that stimulate large-fiber afferent inhibition activity are use of acupuncture (Jichova, Konigova & Prusik, 1983) and transcutaneous electrical nerve stimulation (TENS) (Kimball, Drews, Walker & Dimick, 1987). Strategies that change perception of pain are administration of systemic anesthetics such as nitrous oxide (Filkins, Cosgrave, Marvin, Engrav & Heimbach, 1981) and ketamine (Demling, Ellerbe & Jarrett, 1978), use of hypnosis (Hammond et al., 1983; Wakeman & Kaplan, 1978) and systemic administration of exogenous opioids, such as methadone (Sandidge, 1989) and morphine (Wermeling, Record & Foster, 1986), and of anxiolytics, such as midazolam (Rice & Kyff, 1990). Strategies that foster modulation of the pain impulse through descending control are biofeedback and relaxation (Knudson-Cooper, 1981), stress management (Elliott & Olson, 1983; Wernick et al., 1981) and distraction (Kelley et al., 1984).

Provision of control: a combination of strategies. Provision of control to the patient during dressing change washing (Kavanagh, 1983b; Kavanagh et al., 1991; Tarnowski et al., 1987) may decrease the pain associated with dressing changes in two ways: decreasing small-fiber nociceptor activity and fostering modulation through descending control, by activation of cognitive processes.

Depending on whether the individual patient's style of washing includes firm pressure that is sufficient to stimulate large fibers, a possible third factor may be involved, as well: increasing large-fiber afferent activity. It is not clear whether the apparent decrease in pain during patient-performed washing (Kavanagh et al., 1991; Tarnowski et al., 1987) occurs because patients subtly and continuously self-correct the pressure and stroke direction they employ, because patients pace their self-washing in a pattern that decreases temporal summation, or because patients are less apprehensive and vigilant under conditions of enhanced control than they would be when washed by another person. Regardless of the level of pain transmission at which it impacts perceived pain intensity, provision of control of the burn dressing change seems to be both clinically (Wagner, 1984) and experimentally efficacious.

Gate-control Theory

Gate-control theory (Melzack & Wall, 1965) attempts to explain the nature of perceived pain by examining various key components of transmission of impulses, initial awareness of and response to pain, and modulation of pain intensity. The gate-control theory incorporated known research findings, hypothesized links between established constructs and presented creative solutions to knowledge gaps. Specificity theory concepts of receptor specificity and transmission of messages to the brain through specialized nerve tissue (Boring, 1942) and pattern theory concepts attributing perception of pain to pattern of nerve impulses and to a critical level of nerve cell firing (Melzack & Wall, 1982; Nafe, 1934) were

incorporated with new hypotheses to explain puzzling anecdotal and research findings that were inconsistent with and unexplainable by current theories. The gate control theory refuted both pattern and specificity theories as being incapable of explaining pain's variability, and postulated a control gate at the level of the dorsal horn, and later incorporated a system of descending control capable of both excitation and inhibition (Melzack & Wall, 1982).

Major tenets of the gate-control theory. Melzack and Wall's gate-control theory (1965) suggested that pain processing is modulated through a gate control system, an action system, and a central control trigger. The gate control theory postulated modulation of peripheral nerve impulses by gating at the level of the dorsal horn, in the substantia gelatinosa. The gate control system when "open" is characterized as variable in that differing amounts and character of pain impulse may be conveyed through ascending pathways. The gate control mechanism precedes pain perception but is capable of being "set and reset a number of times as the temporal and spatial patterning of the input is analysed and acted on by the brain" (Melzack & Wall, 1982, p. 233). Consequently, the proposed system is a loop, as modulation occurs and resetting of the gate control system again triggers, or falls short of triggering, the action system. "Although there is evidence, so far, for only presynaptic control, there may also be undetected postsynaptic control mechanisms that contribute to the observed input-output functions" (Melzack & Wall, 1965, p. 975), later incorporated as descending control.

Second, a central control trigger was hypothesized, represented by the dorsal column medial lemniscus system or by the dorsolateral path, that would transmit information rapidly to the brain, activating "selective brain processes that exert control over the sensory input" (Melzack & Wall, 1965, p. 976). Thus, degree of attention, anxiety, tension, depression, past experience, vigilance or excitement can impact the gate control system, further modulating the sensation of pain, producing varying degrees of inhibition or potentiation (Melzack & Dennis, 1980; Melzack & Wall, 1982).

Third, an action system was proposed in which a sequence of events is triggered when a critical preset level is exceeded by first central transmission cells in the dorsal column. The action system begins with reflex responses and continues with strategies for relief or abatement of pain (Melzack & Wall, 1965). Interactions between the gate control and action systems are postulated to occur at any synaptic level; modulation is likewise posited as occurring at any of the synapses of the pain transmission system.

Gate-control theory, revised. Melzack and Wall (1982) described what they denote "gate-control theory: mark II" (p. 234). Reflecting "new facts and ideas" (Melzack & Wall, 1982, p. 234), the revised gate-control theory included a pathway for post-synaptic modulation of the pain impulse. In this second version of the gate-control theory, central control was renamed cognitive control, both excitatory and inhibitory connections were extended from the substantia gelatinosa to transmission cells and, most important, descending inhibitory control was introduced, providing an

inhibitory link from the brainstem system to the substantia gelatinosa, after original transmission through the gate.

Critique. Publication of the gate-control theory was remarkable in two ways: it adopted major tenets of both specificity and pattern theory, marrying them into a plausible whole, and it foretold the existence of undiscovered structures, pathways and mediators. By 1980, the original 1965 article was eighth of the 11 most frequently cited papers in neuroscience publications (Garfield, 1980). However, a major historical review of pain theories (Procacci & Maresca, 1984) acknowledged that specificity and pattern theories are both incomplete and that debate continues on whether a combination theory or either theory alone merits support. Although various combined theories were referenced, no mention was made of the gate-control theory in the review. Bonica (1984) credited the increase in pain research in the 70's and 80's to five primary factors, one of which was "the publication of the Melzack-Wall theory of pain, which generated much interest among other basic scientists" (p. 6). Kruger and Liebeskind (1984) termed the gate-control theory "highly seminal and controversial" (p. vii). Sudarsky (1990) noted that although the theory represented "a step forward in understanding pain control.....Like many a 'patch' used to shore up an existing theory in the face of newer data, it is not strictly correct" (p. 85). Kandel and Schwartz (1985) discussed the lack of evidence of presynaptic inhibition in A-delta fibers and the dearth of physiologic evidence for the gate-control theory as a whole. However, they stressed that, despite incorrect details, the theory is clinically useful

in predicting the effect of interventions and is historically important because of its extension of the concept of pain from solely sensory to sensory-affective-motivational.

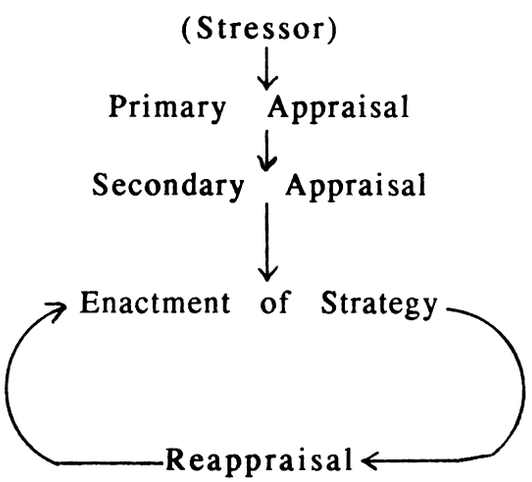
Lazarus's Coping Theory

Lazarus's coping theory attempts to explain how an individual copes with stress, describing a cascade of appraisals and enacted strategies (Lazarus & Folkman, 1984). Prior to Lazarus, there existed no coping theory, per se, but explanations of stress's effect on the individual had been detailed by both Freud (1923) and Selye (1956). Concepts of coping were first described by Freud (1923), who introduced the concept of ego defenses, analogous to emotion-focused coping, which served as the foundation for contemporary coping theories. Selye (1956) described stress as a non-specific physiological response to a physical or emotional demand, implying that other physical or emotional changes can decrease stress to normal levels (eustress). In contrast to other cognitive psychologists, who engaged in an almost semantic debate as to what actions were best classified as adaptation, defense and coping (Haan, 1977; White, 1974), Lazarus regarded all enacted thoughts and actions as forms of coping. He further classified actions that impact the individual or the environment as problem-focused, and thoughts that do not change the individual or the environment as emotion-focused.

Major tenets. Lazarus's theory of the coping process (see Figure 1) consists of six main concepts: coping, primary appraisal, secondary appraisal, reappraisal, problem-focused strategies and emotion-focused strategies. Coping consists of "constantly changing

Figure 1

Lazarus's Coping Theory



cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984). Coping applies to efforts to manage the situation, rather than to effect outcomes. Coping's target is stress-reduction, and it includes whatever a person does or thinks in order to try to manage the situation, whether efficacious or not (Lazarus, 1980).

The primary appraisal is the assessment of a situation in terms of impacting the individual. The situation is judged as irrelevant, benign-positive, or stressful (Lazarus & Folkman, 1984). Stressful situations are further judged as harm-loss, threat, or challenge. Harm-loss represents already sustained damage, threat designates

predicted harm or loss, and challenge denotes potential threat with possibility of gain or growth.

The secondary appraisal is the evaluation of available coping resources and options (Folkman, 1984). This phase represents the choice of a first effort to modify stress.

Reappraisal is the ongoing process of evaluating implemented strategies and their interface with the environment, as new information becomes available (Lazarus & Folkman, 1984). Reappraisal is ongoing and coping is flexible and self-adjusting, fitting emerging circumstances. The cascade of appraisal-coping-reappraisal-coping-reappraisal is continuous, dynamic and ever-changing.

Coping may be problem-focused or emotion-focused. Problem-focused coping is pragmatic and aimed at changing or managing the stress-producing problem or the self, by means of action, inhibition of action or information seeking. Emotion-focused coping changes the meaning a stressful transaction holds for the individual. Emotion-focused strategies are internal or internally-focused, may or may not distort reality, and result in modification of the individual's emotional response.

Evaluation. In contrast with a biological theory that demands tests of veracity, Lazarus's coping theory describes a cognitively-born mechanism, incapable of disproof. However, utility in classifying and describing human reactions to stress is supported by the use of Lazarus's coping theory within the disciplines of cognitive psychology, behavioral psychology and health care. Within health

care, Lazarus's theory has been successfully used to explain, for instance, responses in illness, stressful life episodes, behavior of dental patients, and adjustment to stressors in long-term burn rehabilitation (Cohen & Lazarus, 1979; Corah, 1973; Coyne, Aldwin & Lazarus, 1980; Sutherland, 1988). Lazarus's theory of coping has not been applied to the acute care burn population. However, the theory has been useful in describing emotional reaction to illness, able to explain and classify greatly varied strategies in terms of their ability to decrease stress.

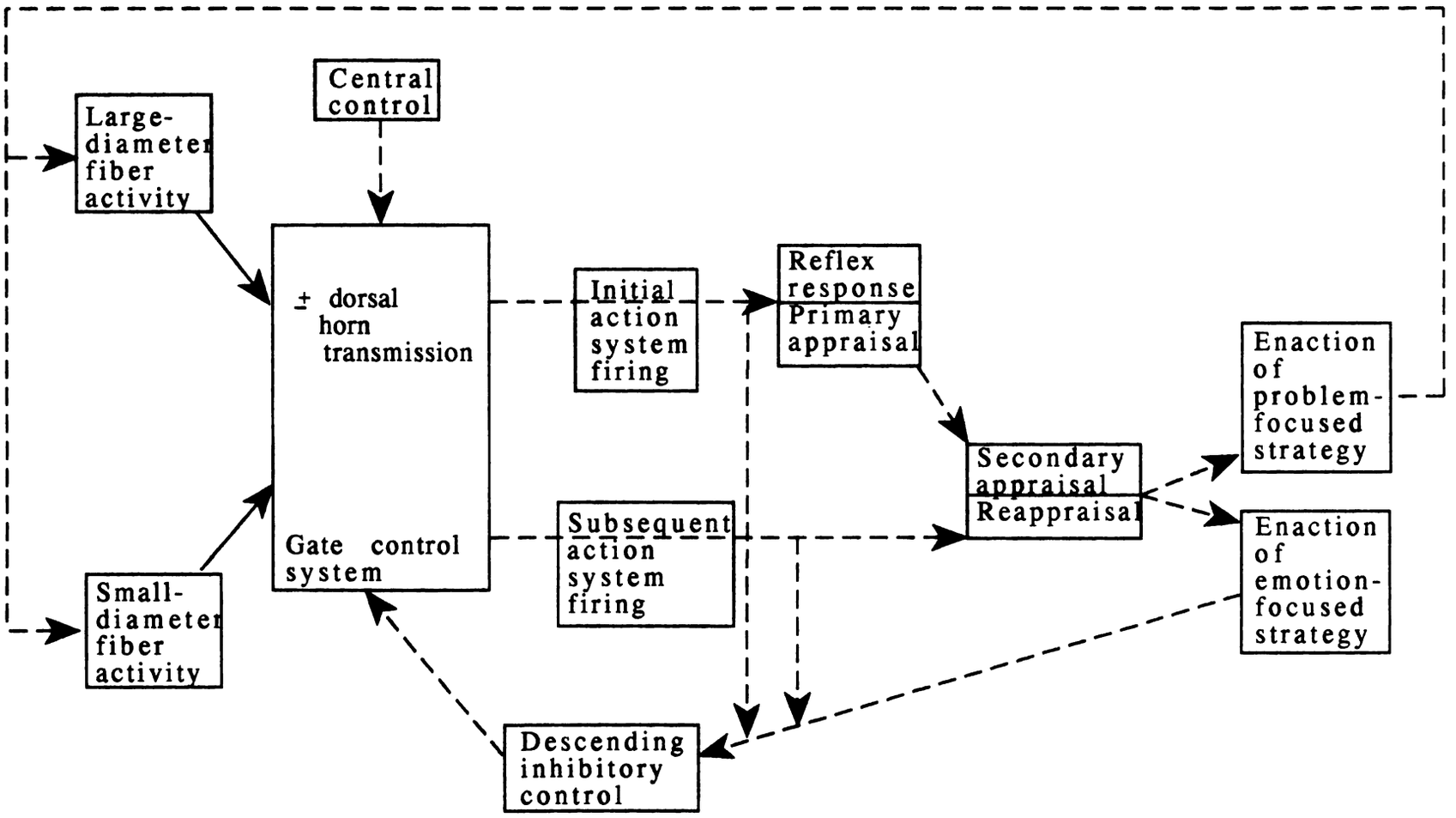
Gate-control Theory and Lazarus's Coping Theory

The gate-control theory and Lazarus's coping theory are combined here with more recent neurophysiological information to produce a framework that attempts to explain the nature of perceived burn pain and the enacted strategies that further modify burn pain quality and intensity, creating a continuous loop. Such a combined gate-and-coping framework (see Figure 2) is useful for explaining the contributions of pain-relief interventions, especially complex interventions, that work at more than one point in the gate-and-coping framework.

In the periphery, information related to tissue damage or destruction is converted to electrical energy by pressure, chemical mediators or electricity, activating peripheral small-diameter primary afferent nociceptors, resulting in transmission of the nerve impulse to the dorsal root ganglion. Transmission to higher centers then occurs, if nociceptive impulses are of sufficient magnitude, if large-fiber inhibitory activity does not prevent transmission, and if a

Figure 2

Gate-and-Coping Framework



adapted from Melzack & Wall, 1982

central pre-set level of ability to be triggered is exceeded (physiologically represented by concentration of chemical mediators), and action system firing results.

With action system firing, initial pain is perceived, and both a behavioral reflex response and primary appraisal are proposed to occur. The primary appraisal gives rise to the secondary appraisal and to enaction of a problem-focused strategy. The primary response produces an early evaluation of the nature of the situation that has caused pain, naming it irrelevant, benign-positive or stressful. Consequently, the secondary appraisal is a problem-solving appraisal, assessing what needs to be done to avoid further stress. If the primary appraisal is that the painful situation is benign-positive or irrelevant, the secondary appraisal will theoretically select the strategy of inhibition of action rather than action, (i.e., there is nothing wrong). Under circumstances of benign-positive and irrelevant primary appraisals, the chosen strategy of inhibition of action is hypothetically accompanied by no increase in apprehension. Consequently, descending control may continue to provide endogenous opioids for modulation of the pain impulse. If the primary appraisal is that the painful situation is stressful, the secondary appraisal is likely to select an action (i.e., escape, massage of the area, application of ice), that is likely to decrease the total number of nociceptive impulses transmitted through the spinal gating mechanism. Pain relief actions selected are early problem-focused strategies intended to modify the stressor of pain. Concomitantly, emotion-focused strategies may be selected that

enhance descending inhibitory control's modulation of the pain impulse. Concurrently, however, alarm and apprehension may alter the level of chemical mediators, serving to increase the total awareness of pain through alterations in descending inhibitory control.

Subsequently, further reappraisals produce additional coping strategies. Problem-focused strategies lead to increased or decreased nociceptive activity and to further modulation by the descending inhibitory control system and to subsequent variabilities in the action system. Emotion-focused strategies probably cannot alter total small-diameter nociceptive contribution to perceived pain but seem capable of altering perception to pain only by means of descending inhibitory control.

Advantages and limitations of the gate-and-coping framework. The advantages of using the gate-and-coping framework to explain changes in perceived pain intensity are that both physical and psychological strategies can be represented, that various nociceptive contributions to total pain sensation as action system firing can be clarified, and that the emotional component of pain is retained as both motivator of emotional strategies and contributor to total experienced pain. The tendency toward reductionism, in treating emotion as a sum-total of autonomic and central nervous system activity, does not represent the humanness that is emotion (Lazarus & Folkman, 1984). Similarly, the representation of the provision of physical control to the patient during the dressing change as only a problem-focused or an emotion-focused strategy, or even as both

problem-focused and emotion-focused strategies, misses the very real contribution that the patient as recipient of action system firing makes in implementing nuances of change in washing technique during dressing change performance.

Limitations of using the gate-and-coping framework to explain burn dressing change pain and interventions for decreasing its intensity are that it produces a complex framework-rendering, that it may be difficult for persons not in healthcare or science fields to comprehend, and that it may be redundant. An argument can be made for descending inhibitory control as adequately and completely representing the results of emotion-focused strategies and for the gate control mechanism to subsume the importance of problem-focused strategies. A parallel argument can be constructed to justify the use of Lazarus's coping theory in isolation.

The Gate-and-Coping Framework and Strategies for Decreasing Burn Pain Intensity

The gate-and-coping framework can be used to explain the locations at which interventions for decreasing burn pain theoretically operate.

Baseline burn pain. After burn injury, small-fiber peripheral nociceptors continue to be activated due to large concentrations of chemical mediators in the periphery, which irritate free nerve endings, and also due to hyperalgesia (LaMotte, 1984), resulting from the increased transmission of impulses that occurs with summation. Spontaneous activation of nociceptors and activation in response to

subtle changes in position produce transmission to the dorsal horn; action system firing results.

Stimulation of large-fiber primary afferents activates inhibitory interneurons which modulate pain's intensity and quality. It is not known if the burn patient at rest experiences large-fiber afferent modulation.

Central control, reflecting anxiety, fear, tension, vigilance or excitement, establishes the initial background baseline state that increases or decreases the individual's preset level of sensitivity to noxious stimuli.

Descending control, reflecting changes in anxiety, fear, and mood in response to the situation, provides greater or lesser modulation of burn pain, through cortical stimulation of brain areas rich in endogenous opioid peptides. Decreased stimulation results in greater perceived pain; increased stimulation results in diminished perceived pain.

Perceived pain is represented by action system firing and results in a primary and a secondary appraisal for initial pain and a reappraisal for subsequent pain. Enaction of problem-focused strategies, such as elevation of burned extremities, change in position, and deep pressure, contributes to large- and small-diameter primary afferent firing. Enaction of emotion-focused strategies, such as relaxation attempts and distraction, modulates pain through descending inhibitory control.

Procedural burn pain. Superimposed upon the above events is the dressing change procedure. Small-diameter primary afferents

are stimulated far in excess of baseline levels through removal of adherent dressings and washing of burn wounds. Transmission of impulses to the dorsal horn hypothetically increases. If the washing is done with firm pressure, some large-fiber primary afferents may be stimulated, as well, modulating the pain stimulus at the dorsal horn. Despite this modulation, increased dorsal horn transmission of noxious stimuli to cortical centers is likely to result. Before the dressing change is initiated, a level of preset sensitivity to noxious stimuli is established through central control. As the central control trigger is activated, action system firing results. Subsequent descending control, after action system firing, modulates pain perception, to a greater or lesser degree, in response to the patient's emotion-focused strategies of rationalization of the experience, reinterpretation of the pain, or other strategies that involve thought. Other than to pull away from the person trying to perform the dressing change or to refuse to be washed, the patient can do little to change small-fiber primary nociceptive input.

Procedural interventions. Routine procedural interventions for dressing changes may include administration of pre-procedure opioids and anxiolytics, provision for the patient of ongoing information about what will be done to the burn wounds, and distraction by conversation or music. Additional interventions might include use of a washing technique that is very gentle or very firm, and provision of assistance for the patient to relax (i.e., deep breathing, guided imagery). Opioid administration may reset the central control trigger and dull perception of pain. Anxiolytic

administration may reset the central control trigger or may facilitate modulation of pain through the body's descending control system by decreasing anxiety. Provision of information seems to enhance the contribution of descending control through decrease in apprehension and vigilance. Distraction changes the focus of attention, possibly facilitating an increased contribution of descending control. Use of a very gentle washing technique decreases small-fiber nociceptive afferent input. Use of a firm washing technique stimulates large-fiber primary afferents, which activate inhibitory interneurons, modulating nociceptive input.

Provision of physical control to the patient during the dressing change. Provision of physical control to the patient during the dressing change is interpretable at a number of points in the gate-and-coping framework. The patient's decision to assume physical control during the dressing change constitutes enaction of both a problem-focused and an emotion-focused strategy. The problem-focused strategy enacted is performance of self-washing, which produces a different pattern and amount of small-fiber and large-fiber firing, depending on personal technique. It is expected that the patient's response to a sudden increase in pain with a certain style of washing would produce a halt in that technique and an alteration to a less painful technique. Washing technique may or may not include a component of large-fiber primary afferent modulation, depending on individual technique.

The emotion-focused strategy enacted is the change in point of view concerning the dressing change procedure, an estimate of being

in physical control instead of being passive. Additionally, there is an attentional focus on the wounds rather than on the nurses performing the dressing change. Arousal state may decrease from high to moderate levels. Apprehension, anxiety, and tension may decrease. Changes in attention, arousal, anxiety, apprehension and tension contribute to enhancement of descending control's modulating effect.

Theoretical Overview of Control

Control in a burn unit context. Webster's defines control as "power to direct or regulate." Control as actual physical participation in self-washing during the dressing change has been researched in children (Kavanagh, 1983b; Kavanagh et al., 1991; Tarnowski et al., 1987), although control, in a larger sense, encompasses all areas in which the patient has power.

Control and gate-control theory. Control as physical participation in dressing change self-washing, from the perspective of the gate-control theory, may impact peripheral nociceptive firing and descending inhibitory control during procedures. Provision of physical control over washing enables patients to self-correct their washing technique in response to action system firing, changing the number and distribution of small-fiber nociceptive afferent impulses generated. Provision of opportunities for the patient to control aspects of procedures and treatments changes the balance of attention, anxiety, tension, fear, depression, past experience, vigilance and excitement, impacting descending control. Thus,

provision of physical control to patients may contribute in at least two different ways to reduction of perceived pain intensity.

Control and Lazarus's coping theory. Folkman (1984) has examined the role of personal control in stress and coping processes. "Efforts to exercise control are synonymous with coping" (Lazarus & Folkman, 1984, p. 197). However, it is not necessarily true that "if an individual believes he has some control over what is happening to him in a threatening environment, he will experience less stress than if he believes he has no control" (Corah, 1973, p. 1261), because the individual's response determines whether control decreases or increases stress. Theoretically, control efforts by the individual are synonymous with coping, but control over a situation may or may not decrease stress, because increased control implies increased responsibility for a stressful situation (Folkman, 1984). Problem-focused efforts may be enhanced if the introduction of control changes a stress appraisal from threat to challenge, augmenting positive emotions such as optimism, eagerness and excitement (Folkman, 1984). Coping may be negatively affected if social conflict results from enhanced control or in conditions in which enhanced control is unexpected or unsupported (Folkman, 1984). The meaning of control, situationally, the actual amount and nature of the control, and the fit between perceived and actual control all impact coping in control-provision situations (Folkman, 1984).

Studies of the value of providing control over aversive stimuli to pedodontic dental patients (Corah, 1973) demonstrated that in patients given a signaling device to provide stop and go signals for

dental procedures, level of arousal decreased for high-arousal procedures, such as high-speed drilling and injections. According to Thompson (1981), control enhanced the children's ability to prepare for pain by affording predictability, and control also fostered positive coping outcomes by enhancing feelings of competency and minimizing hopelessness.

Review of the Literature

Background

The first published research detailing results of a specific intervention effective in burn pain relief was Crasilneck, Stirman, Wilson, McCranie and Fogelman's (1955) description of the effectiveness of hypnosis in reducing pain in three of eight burn patients. In the intervening period of almost four decades, approximately 120 studies have been generated that describe the natural history of burn pain, compare perception of burn pain acuity from patients' and nurses' points of view, correlate burn pain with other intrapsychic, behavioral or pharmacological variables, or describe effects of self-generated and other-generated strategies in reducing burn patients' pain. In the decade 1981-1990. there were approximately 40 major publications, excluding case studies, examining research interventions for burn pain relief. Whereas publications of the fifties and sixties were sparse, and often focused upon hypnosis, recent research spans the gamut of possible interventions from strict intrapsychic to biofeedback, from TENS to opioids.

The Scope of the Review

This review of research literature in and around the area of decreasing perceived procedural burn pain intensity is as complete as possible. Using the Melvyl medline computer program, a preliminary literature search was initiated and all pertinent articles read. Then a hand-search was completed of eleven years of Journal of Burn Care and Rehabilitation, eight years of Burns, Including Thermal Injury, eleven years of Heart and Lung, six years of Pain, three years of Western Journal of Nursing Research, and three years of Nursing Research, and all germane articles reviewed. The "recent burn references" section of Burns, Including Thermal Injury was hand-searched, yielding further readings. Pertinent second-generation references from all the above articles were reviewed.

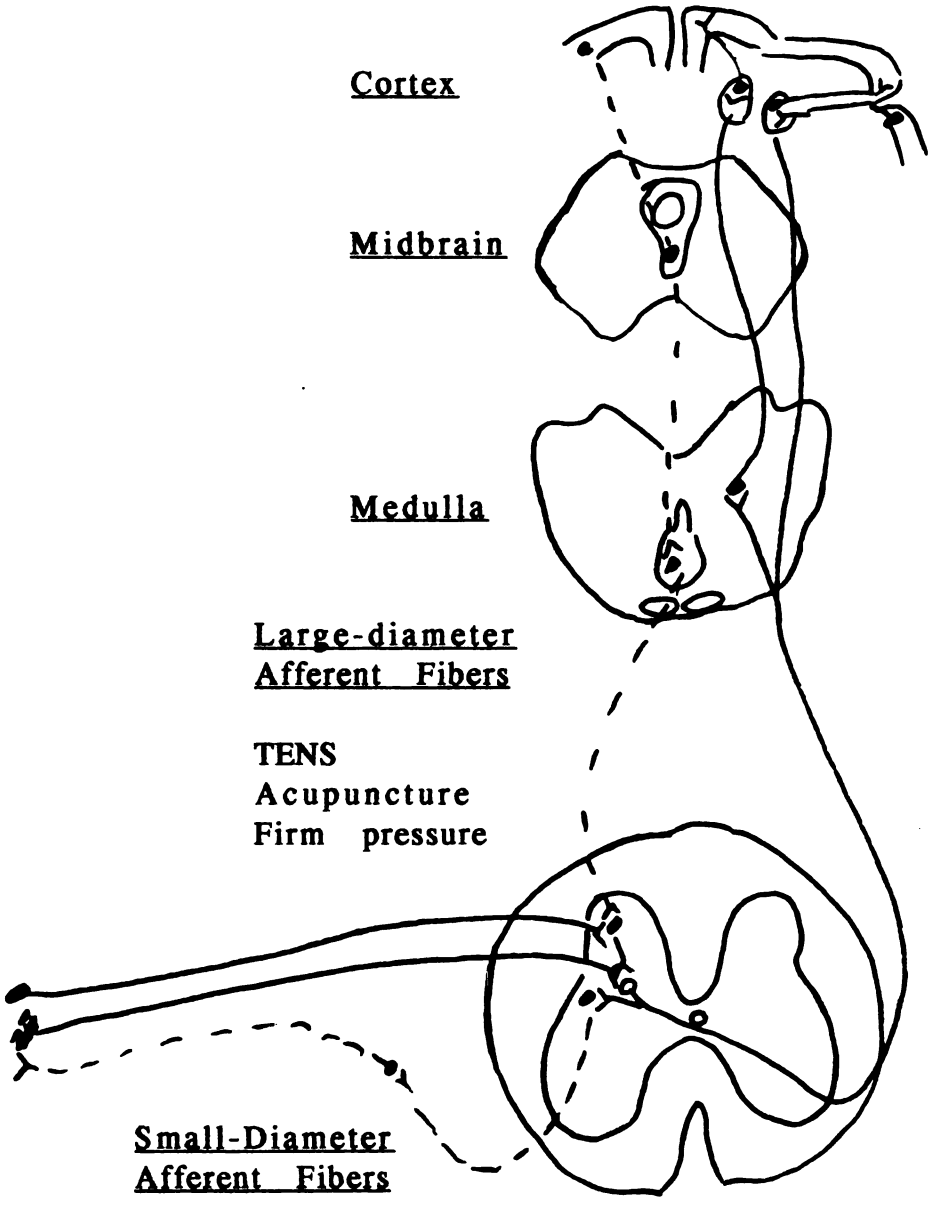
Organizing Framework

Burn patients experience both baseline and procedural pain. Baseline pain is relatively constant, contributing to total perceived pain but varying little in intensity over time. Burn patients identify dressing changes as being the most painful experiences of their hospitalization (Perry et al., 1981). Severe pain does not terminate at the last moment of the dressing change, however, but rather decreases over time, minutes to hours, until baseline pain level is again reached (Atchison et al., 1991). Hence, burn pain has three temporal segmentations: procedural pain, post-procedural pain and baseline pain.

Fields and Levine (1984) presented a schematic of sites of action of various medications and interventions (see Figure 3),

Figure 3

Sites of Action for Burn Pain Interventions



adapted from Fields & Levine, 1984

readily adaptable to burn pain interventions. Small-fiber peripheral afferents represent the site of action for topical analgesic agents, for alternative topical dressings, and for different strategies of washing the burned area. Large-diameter myelinated axons are the site of action for TENS, firm pressure applied while washing the burned area, and probably acupuncture. The medulla and midbrain, and possibly areas of the cortex, are sites of action for systemic medications, such as opioids and inhalation anesthetics. The cerebral cortex, or cognitive level, is the site of action for hypnosis, spontaneously generated strategies, taught strategies, behavior modification, control-provision and cueing.

Burn pain research literature, then, can be divided into three broad areas, by the type of pain each study addresses: procedural, post-procedural or baseline. The three broad areas can be further subdivided into groups, according to Fields and Levine's (1984) grouping of sites of interventional strategies, representing peripheral small-fiber, peripheral large-fiber, systemic and cognitive strategies. A thirteenth group, representing a non-burn cognitive procedural strategy, is included.

A brief overview of peripheral small-fiber, peripheral large-fiber and systemic strategies within each area is presented. Research employing cognitive strategies within all areas is reviewed in detail, with the exception of hypnosis. Hypnosis, a distinct strategy unto itself, is not reviewed. The oldest researched method of burn pain control, hypnosis literature represents the plurality of burn literature, if case studies are included. However, the use of hypnosis

within a facility depends upon institutional support of the method and upon individual nurses' willingness to pursue its use. The chief disadvantage of the use of hypnosis for burn pain modification is that, despite the fact that almost all persons can be hypnotized (Patterson, Questad & de Lateur, 1989), efficacy for reduction of procedural burn pain is unpredictable for each individual patient (Bernstein, 1965); that is, there is no predictable effect interindividually capable of producing a consistent level of pain relief.

Review of the Literature

Procedural Burn Pain

Peripheral small-fiber nociceptor strategies. Research studies examining peripheral small-fiber nociceptor strategies for control of procedural burn pain (see Table 1, Appendix A) are many. Cruse and Daniels (1989), Gerding, Imbembo and Fratianne (1988), Guilbaud (1992), Miller et al. (1990a), Phillips et al. (1989), Sawada, Ara, Yotsuyanagi and Sone (1990), Sawhney (1989), Sinha and Swaroop (1988), Subrahmanyam (1991) and Yang (1990) detailed use of alternative wound topicals and coverings, including biosynthetic skin substitutes, amniotic membrane, antibacterials, antibacterial-impregnated coverings, pig collagen, and honey, that decreased the frequency of or totally eliminated the need for dressing changes, or accelerated healing time, thereby decreasing the number of procedures and attendant pain. Han and Maitra (1989), Miller et al. (1990b) and Terrill, Kedwards and Lawrence (1991) described use of antibacterial-impregnated coverings, GORE-TEX bags used over

topicals, and alternative use of antibacterials that did not significantly impact procedural pain or number of dressing changes.

Peripheral large-fiber (inhibitory) strategies. The single publication describing a strategy for decreasing procedural pain through peripheral large-fiber recruitment is Jichova et al.'s (1983) description of the use of acupuncture (see Table 2, Appendix A). Authors reported that, in subjects with first- and second-degree burns of 30% total burn surface area (TBSA) or less, acupuncture was used before the dressing change and halved analgesic requirements. Acupuncture was used repeatedly in some cases, every day or on alternate days.

Systemic strategies. Research studies reviewed that examined systemic strategies for actual or potential control of procedural burn pain (see Table 3, Appendix A) are nine. Three studies addressed procedural burn pain control through use of opioids. Osgood and Szyfelbein (1990) described differences in moment-to-moment self-reported pain scores by two 15-year-old young men with 20% and 58% TBSA during dressing changes with fentanyl as compared with oxycodone, noting lower pain scores when subjects received fentanyl. Lee (1987) and Lee, Marvin and Heimbach (1989) examined self-reported pain before, during and after dressing changes in adults administered nalbuphine as compared with morphine, one study with and one without nitrous oxide. In both studies, nalbuphine's analgesic effect was found to be as potent as morphine's.

Several studies addressed non-opioid control of procedural burn pain. Filkins et al. (1981) described the use of nitrous oxide in

adult male patients, all but one of whom experienced pain relief. Rice and Kyff (1990) described the use of intranasal midazolam to a burned child prior to the procedure of starting a central venous line. Of the studies describing ketamine for burn procedures, four are representative (Demling et al., 1978; Groeneveld & Inkson, 1992; Martinez, Achauer & Dobkin-de Rios, 1985; Ward & Diamond, 1976). Despite some patients' reports of subjective distress related to ketamine's dissociative effects (Martinez et al., 1985) and to nausea (Groeneveld & Inkson, 1992), and one documented incident of aspiration pneumonia after an NPO period of only three hours (Ward & Diamond, 1976), adult patients were satisfied with the drug (Ward & Diamond, 1976) and children requested its readministration (Demling et al., 1978). Because of the sedative effects of both nitrous oxide and ketamine, concurrent pain ratings were unobtainable and retrospective reports unquantifiable in terms of pain.

Cognitive strategies. Researched cognitive strategies for control of procedural burn pain consist of two groups: purely cognitive strategies and mixed strategies that seem to act at both small-fiber afferent and cognitive levels.

Purely cognitive strategies. Purely cognitive strategies for control of procedural burn pain (see Table 4, Appendix A) are five. Kelley et al. (1984) and Miller, Hickman and Lemasters (1992) researched the effect of distraction during the dressing change upon children (Kelley et al., 1984) and adults (Miller et al., 1992); Kelley et al. (1984) addressed the effect of rewarded cartoon viewing upon pain behaviors in two children, aged four and six, with 29-35% TBSA,

and Miller et al. (1992) focused upon voluntary viewing of films of scenic beauty in 17 adults, with mean burn size of 20% TBSA. Savedra (1976) described burned children's spontaneously generated strategies for coping with pain; each of her sample of five children, aged six to nine and a half years, and with 30-65% TBSA, was observed over a period of months of hospitalization. Wernick et al. (1981) and Elliott and Olson (1983) studied the effect of stress-management programs upon burned adults and children respectively; Wernick et al.'s 16 adult subjects had burns of at least 15% TBSA and Elliott and Olson's four pediatric subjects had burns ranging from 5 to 68% and were aged five to twelve years. Savedra's (1976) study was descriptive, the two other children's (Elliott & Olson, 1983; Kelley et al., 1984) studies were quasi-experimental investigations of the efficacy of interventional strategies for pain relief, and the two adults' (Miller et al., 1992; Wernick et al., 1981) studies were experimental tests of interventional strategies.

Pain was operationalized in various ways in the experimental and quasi-experimental studies. Both children's studies used observed distress behaviors to approximate pain, Wernick et al. (1981) utilized a 1 to 100 point self-rating of pain tolerance, and Miller et al. (1992) used a pain rating scale.

All four studies using cognitive strategies demonstrated support for the interventions' effectiveness. A positive correlation ($p < .05$), was demonstrated between pain behaviors and cartoon viewing by Kelley et al. (1984). Elliott and Olson (1983) did not

attempt statistical analysis, presenting percentages and graphs indicating stress-management's effectiveness in diminishing pain behaviors. Miller et al.'s (1992) study supported the use of distraction for decreasing procedural pain ($p < .05$). Wernick et al.'s (1981) subjects reported greater pain tolerance for dressing changes, comparing pre- with post-treatment ($p < .05$).

A limitation of Kelley et al.'s (1984) design is the possibility that pain behaviors were altered by the intervention, rather than pain itself modified. Limitations of Wernick et al.'s (1981) design are the absence of equalization of treatments between groups and the possibility that pain tolerance, rather than pain intensity or quality, was affected by the intervention. The three studies of children had very small sample sizes, not problematic in Savedra's descriptive design but a limitation in Elliott and Olson's (1983) and Kelley et al.'s (1984) studies.

Mixed cognitive-peripheral strategies. Strategies that act at both cognitive and peripheral levels in controlling procedural burn pain (see Table 5, Appendix A) are four. Kavanagh (1983a), Kavanagh (1983b), Kavanagh et al. (1991) and Tarnowski et al. (1987) researched provision of physical control of burn dressing changes to children and the effect upon maladaptive behaviors and wound healing (Kavanagh, 1983a, 1983b; Kavanagh et al., 1991), and upon behavioral distress (Kavanagh, 1983b, Kavanagh et al., 1991; Tarnowski et al., 1987). Kavanagh's (1983a) pilot study described the behaviors of two children treated with the control method of nurse-performed dressing changes and five children treated with the

experimental method of self-performed dressing changes, insofar as the children could participate in them; subjects were aged 14 months to 11 years, with 7-40% TBSA. Kavanagh's (1983b) second study was a nonconcurrent quasi-experimental design comparing children's behaviors under the conditions of nurse-performed dressing changes, as opposed to patient-performed dressing changes, with eight subjects, aged 2-12 years, with 12-85% TBSA, four control subjects studied one month and four experimental the next month. Kavanagh et al.'s (1991) third study researched the impact of patient-performed dressing changes in 32 subjects, aged 16 months to 16 years, with 2-58% TBSA, studied at two different sites, and randomly assigned to the experimental or control group at each site. Kavanagh's theoretical framework is Seligman's (1975) theory of helplessness, incorporated in the study's conclusions. The third study (1991) addressed new variables of serum beta-endorphin and cortisol, as well, theorizing that the causes for their elevation in the control group paralleled Seligman's (1975) animal research on learned helplessness.

The three Kavanagh (1983a, 1983b, 1991) studies all established a difference in the behaviors of children between the experimental and control conditions. Under the experimental conditions, children displayed less procedural distress (1983a, 1983b, 1991), their anxiety and pain decreased over time (1983a), they displayed fewer maladaptive behaviors at non-dressing change times (1983b), they required less opioid administration

intraprocedurally (1991) and they displayed less depression after discharge from the hospital (1991).

Tarnowski et al. (1987) studied provision of physical control of the dressing change in a 12-year-old boy with 25% TBSA, using a repeated reversal design. In their graphical display of data, the authors presented the results that the subject's distress during the procedure averaged 5.7% when he performed his own dressing changes and averaged 63.0% when the physical therapist performed his dressing changes. Tarnowski et al.'s (1987) argument for the intervention of patient control of the dressing change as the sole cause of the decrease in behavioral distress is elegant and logical.

A limitation in all four studies is the absence of a pain scale. It has been demonstrated that children eight years and older can use a pain tool that gives information related to location of pain, pain intensity and quality of pain (Tesler, Savedra, Ward, Holzemer & Wilkie, 1988). Kavanagh et al.'s 1991 study used 28 of its 32 subjects for statistical analysis, a large sample for pediatric pain research, but the limitation of small samples exists for the other three studies. A limitation of Kavanagh's second study (1983b) was its non-concurrent data collection, introducing a history threat to internal validity. Kavanagh (1983b) stated that the second study's quasi-experimental design was chosen to avoid the threat of compensatory equalization of treatment, potentially present if nurses observed the benefits of the experimental treatment and subtly provided some participation in the dressing change for the control group. The later Kavanagh et al. (1991) study included random

assignment to control and experimental groups, and produced similar experimental results.

Tarnowski et al.'s (1987) design of repeated reversal controlled well for compensatory equalization of treatment and history threats. A limitation of this study, however, is that its degree of internal validity depends upon whether self-mediated debridement was the sole difference between the "A" days and the "B" days in the ABAB design, which is uncertain because of the difference in quality of debridement between the "A" days and the "B" days, as rated by the physical therapist.

Clinical implications of procedural strategies. In general, research studies examining procedural strategies' effectiveness for modification of burn pain intensity are isolated and unconnected with one another. As a whole, the procedural small-fiber studies represent single or repeated product trials, some of which appear to decrease perceived pain or to hasten healing. A limitation, therefore, is that, with the exception of the Biobrane studies (Gerding et al., 1988; Phillips et al., 1989) and Guilbaud's (1992) multi-site European trial of Inerpan, each study represents a lone trial and has not been replicated. A major limitation is that this group of studies addresses partial-thickness burn wounds, which appear appropriately treated with a variety of topicals but which do not represent an appreciable proportion of a regional burn center's inpatient population. Limitations of the Jichova et al. (1983) procedural large-fiber study are its retrospective nature and the fact that it is an isolated, non-replicated study. Research studies within the procedural systemic

group include various single studies, the paired publications of nitrous oxide by Lee (1987) and Lee et al. (1989), and the cluster of ketamine research. Conspicuous by their absence are studies of the common and widely-used (Denson, Concilus, Warden & Raj, 1990) opioids often employed in intravenous form for burn procedural pain, chiefly morphine but also including meperidine and fentanyl. Within the systemic procedural group, the strongest evidence for efficacy is the collection of ketamine studies, which together support the use of ketamine for burn dressing changes of both adults and children. Within the procedural cognitive group of studies, there is a single descriptive study of self-generated strategies and there are two pairs of parallel studies, each pair examining the effect of either distraction or stress management in an adult and a pediatric sample. As such, each pair of studies represents only preliminary support for the strategies they describe and does not provide specific direction for practice without confirmatory research. Within the cognitive-peripheral area, Kavanagh's series (1983a, 1983b, 1991) of studies and Tarnowski et al.'s (1987) research represent some support for the intervention of provision of physical control in children, although there is not unequivocal support for this strategy. More research is needed to address perceived pain instead of observed pain in the pediatric population and to explore the efficacy of the approach of provision of physical control in an adult population. Within the pediatric population, additional research with pain scales would support Kavanagh's (1983a, 1983b, 1991) and Tarnowski et al.'s

(1987) findings relative to decreased pain with self-washing during burn dressing changes.

In summary, within the procedural group of strategies, more knowledge is needed concerning the comparative effectiveness of various topicals and coverings as they impact burn pain, the relative efficacy of the array of systemic medications, especially intravenous opioids, and their drawbacks in clinical use, the effectiveness of cognitive strategies in the modification of pain, and the extent to which provision of physical control is effective in modifying burn pain intensity.

Post-Procedural Burn Pain.

Peripheral small-fiber nociceptor strategies. In the isolated post-procedural small-fiber study, Brofeldt et al. (1989) described use of topical lidocaine-bacitracin cream (see Table 6, Appendix A). Concurrent self-reported pain by 30 adult subjects at thirty minutes post-procedure was significantly less ($p < .05$) by t-test than at a procedural break after washing but prior to lidocaine administration. Comparison was also made in five subjects between similar areas with lidocaine-bacitracin on one area and bacitracin-bismuth gauze on the other, showing a significant ($p < .005$) difference in pain.

Peripheral large-fiber (inhibitory) strategies. Post-procedural large-fiber (inhibitory) strategies (see Table 7, Appendix A) are two. Lewis, Clelland, Knowles, Jackson and Dimick (1990) and Kimball et al. (1987) investigated auricular acupuncture-like TENS and conventional TENS and their effectiveness in modulating burn pain intensity. Lewis et al. (1990) compared TENS with placebo for relief

of pain after dressing changes, and Kimball et al. (1987) compared TENS with morphine in patients treated with Travase, a painful enzymatic debridement agent applied to the burn wound and left in place after the dressing change. Kimball et al.'s (1987) study of 12 experimental subjects and 12 controls showed no significant difference in pain between TENS and morphine subjects. Lewis et al.'s (1990) research showed no difference in pain pre-TENS and post-TENS when treatment only was examined but found that both time and time x treatment were statistically significant. Low power due to a small sample size of 11 may have contributed to the lack of statistical significance of treatment alone.

Clinical implications of post-procedural strategies. Post-procedural research is represented by only three articles, one examining the use of lidocaine cream (Brofeldt et al., 1989) and two researching TENS. The lidocaine cream article represents an isolated research finding. The TENS articles, although using different techniques, lend preliminary support for the use of TENS in burn pain. At this time, there is insufficient evidence on which to rely in designing clinical practice.

Within this area of studies, more needs to be known about the long-term effects of use of lidocaine on a burn and about the variation in pain response when lidocaine is used. Not reported in the article is the fact that lidocaine used topically produces an intense burning sensation for a period of approximately ten minutes (Debbie Doherty, personal communication, November 1991). This extreme discomfort may not be acceptable to all patients.

Future TENS research in burns would be well directed toward examining different sites for use of TENS in the burn patient and toward confirming Lewis et al.'s (1990) and Kimball et al.'s (1987) work. It is not known how auricular TENS in burn injury modifies pain. Although TENS theoretically operates on large-fiber afferents, auricular TENS may affect descending inhibitory control as well. The mechanism of TENS auricularly placed requires additional research. From the aspect of directing practice, the post-procedural area of research studies does not contribute sufficient evidence upon which to base clinical practice.

Baseline burn pain

Small-fiber (peripheral) strategies. Although systemically administered, intravenous lignocaine (lidocaine) infusion seems to work in the periphery in relation to achievement of appropriate serum levels. Using a single-subject reversal design for seven burned patients, Jönsson, Cassuto and Hanson (1991) described significant ($p < .05$) decrease in pain in burn patients given a continuous infusion of lignocaine, with additional boluses for dressing changes (see Table 8, Appendix A).

Systemic strategies. Baseline systemic studies for control of burn pain intensity (see Table 9, Appendix A) are nine. Five studies addressed the use of morphine sulfate delivered by patient-controlled analgesia (PCA) machines, two using prospective randomized studies (Choiniere, Grenier & Paquette, 1992; Cram & Kealey, 1990) and three employing descriptive designs (Gaukroger, Chapman & Davey, 1991; Kinsella, Glavin & Reid, 1988; Wermeling et

al., 1986). Concilus, Denson, Knarr, Warden and Raj (1989) and Denson et al. (1990) described pain and related pharmacokinetics in burn patients given a continuous intravenous infusion of methadone. Alexander et al. (1992) and Sandidge (1989) used quasi-experimental designs to demonstrate the effectiveness of long-acting oral morphine (MS Contin) and oral methadone, respectively, in controlling baseline burn pain.

The two experiments involving PCA morphine for relief of baseline burn pain are a double-blind study of 24 patients by Choiniere et al. (1992), in which PCA morphine and bolus PRN saline versus PCA saline and bolus PRN morphine were compared, and a comparison of pain relief between bolus PRN and PCA morphine by Cram and Kealey (1990). Not surprisingly, there was no significant difference between Choiniere et al.'s (1992) groups, as the placebo effect of PCA was eliminated, but patients used slightly more morphine by the PCA route and experienced slightly less pain, although neither finding was statistically significant. Cram and Kealey (1990) found that patients who were given PCA machines with morphine used significantly more morphine than did the bolus PRN group, and the patients also experienced significantly less pain, with an absence of adverse side effects. It is not clear whether Cram and Kealey's (1990) study is more applicable to route of medication delivery or to amount of medication administered, because it is possible that the PRN bolus patients in this study were inadequately medicated.

The three descriptive studies of PCA morphine vary in their usefulness. Gaukroger et al. (1991), in an analysis of the safety and effectiveness of PCA morphine in 11 burned children, demonstrated that vital signs were within normal limits and that 92% of pain scores indicated mild pain or less between dressing changes. Kinsella et al. (1988) provided simple information that PCA morphine, without baseline infusion, had been used for eighteen postoperative and five acute burn patients. Wermeling et al. (1986) presented a case study of a burn patient whose pain was controlled with PCA morphine after failure with PRN morphine IV boluses; the patient's PCA dose, at its maximum, was 13 milligrams (mg.) per bolus with a six-minute lockout, and the patient experienced no respiratory depression.

Studies of IV methadone provided by continuous infusion (Concilus et al., 1989) and pharmacokinetics of IV methadone (Denson et al., 1990) provided some support for IV methadone use in burn patients. Concilus et al. (1989) found that in 17 patients with poor pain control on previous regimens, IV methadone provided relief of pain for 70% of patients at two hours into the treatment and for 80% of patients 24 hours into the treatment. The authors recommended close observation and periodic arterial blood gas (ABG) determinations, however, because of the significantly lower respiratory rate observed and because of retention of carbon dioxide in one patient and intubation in another, possibly due to confounding variables. Denson et al. (1990) studied 14 of the above 17 subjects and recommended using the same loading dose of methadone at the beginning of infusion but doubling the maintenance dose, due to

subtherapeutic serum levels of methadone in most subjects. It is noteworthy that subtherapeutic methadone levels provided pain relief to 80% of the subjects and it seems probable that, with therapeutic serum levels, pain relief could approach 100%.

Alexander et al.'s (1992) and Sandidge's (1989) research of the effectiveness of long-acting oral opioids administered in an around-the-clock schedule for control of burn pain demonstrated that pain control was equal to that achieved through the use of PRN IV morphine (Alexander et al., 1992) and superior to that achieved through the use of PRN oral medications (Sandidge, 1989). Both studies demonstrated equal morphine-equivalents in experimental and control groups. In the Sandidge (1989) study, patient satisfaction was greater with methadone.

Cognitive strategies. Baseline cognitive studies (see Table 10, Appendix A) are four, representing one study (Blew, Patterson & Questad, 1989) of spontaneously generated strategies for reduction of pain and three reports of interventions (Knudson-Cooper, 1981; Shorkey & Taylor, 1973; Tobiasen & Hiebert, 1985) designed to reduce pain or distress behaviors. Subjects included a 17-month-old with 37% TBSA in Shorkey and Taylor's (1973) case study; 20 adults aged 17 to 63 years, with 10-50% TBSA, in Tobiasen and Hiebert's (1985) experimental study; 27 children aged 7 to 16, with burns greater than 10% TBSA in Knudson-Cooper's (1981) quasi-experimental study; and 44 adults with mean age 38.1 years and mean TBSA 8% in Blew et al.'s (1989) description of coping strategies.

Strategies described as effective by Blew et al.'s (1989) subjects were self-distraction, talking about the pain, thinking about something else, concentrating one's attention on something else and imagining oneself elsewhere. The intervention described by Shorkey and Taylor (1973) was behavior management through visual cueing, in which staff and family clothing and the subject's room lights were color-coded to represent treatment conditions and non-treatment conditions. This color-coding reduced the subject's maladaptive global aversion to all adults within 24 hours, reversing it completely within two weeks. A strength of the Shorkey and Taylor (1973) study is its clear conceptualization of theoretical and operational variables.

The interventions studied in the experimental and quasi-experimental studies were preparation in coping strategies (Tobiasen & Hiebert, 1985) and relaxation or biofeedback (Knudson-Cooper, 1981). Tobiasen and Hiebert's (1985) study utilized a strict experimental design that provided for equal time with the investigator for controls. Knudson-Cooper's (1981) utilized a quasi-experimental design, matching for age, gender and TBSA.

Knudson-Cooper's (1981) subjects demonstrated significant reduction in "not feeling good" and in anxiety, by biofeedback ($p = .005$) and by relaxation ($p < .0001$). Tobiasen and Hiebert (1985) reported that at the .05 level of significance, treatment subjects differed from controls by reporting less worry about pain, among five other variables, but "feeling comfortable" did not differ significantly between groups.

A limitation of the Knudson-Cooper (1981) and Tobiasen & Hiebert (1985) studies is the avoidance of the word pain in eliciting subjects' estimates of the pain experience. Knudson-Cooper (1981) used the phrases "feeling good" and "not feeling good," addressed as a binary variable, and Tobiasen and Hiebert (1985) used the term "feeling comfortable," measured on a 1 to 7 scale, but in both studies' results and discussions sections, these outcome variables were interpreted as pain. Both studies would have benefited by a pain scale. An additional limitation of the Tobiasen and Hiebert (1985) study is that it can be interpreted as having measured coached feelings of competency rather than burn pain.

Clinical implications of baseline strategies. Baseline strategies represent, as do procedural and post-procedural, primarily isolated studies examining various approaches to modification of burn pain intensity. Jönsson et al.'s (1991) lignocaine study is the sole baseline small-fiber study. As one piece of research, it does not provide clinical rationale for adoption of the treatment but requires supportive studies in different populations that also address serum lignocaine levels.

With the support of five PCA morphine studies, one can conclude that PCA morphine appears to be safe and that patients studied have self-administered more morphine and experienced more pain relief using that method than with PRN IV bolus morphine administration. In general, baseline systemic strategy studies support continuously administered or continuously available opioids, and in that respect are at least in agreement; however, studies are

only somewhat interrelated, and they do not consequently build stratified evidence for one opioid or another. Respiratory depression was an identified risk only in the IV methadone studies, not the PCA morphine or oral opioid research. Clinically, one may derive the conclusion that medication for baseline pain with opioids is beneficial, safe (with monitoring, in the case of methadone), and acceptable to the patient. However, from a scientific standpoint the evidence does not represent unequivocal support for any method or even for use of continuously-administered opioids, in general.

Baseline cognitive strategies represent isolated studies. No one strategy is supported sufficiently for determination of clinical practice. However, the baseline cognitive strategies of relaxation, biofeedback, and preparation in coping are standard types of noninvasive interventions commonly used in clinical practice. Because of their benign and cost-free nature, and because there is some preliminary evidence supporting their use, it is important to confirm their efficacy through subsequent research. Basing practice on one strategy or another is not indicated, but continuing to practice a cognitive strategy that seems to work clinically is at least upheld pragmatically, if not scientifically.

Non-Burn Procedural

A non-burn procedural strategy related to burn dressing change pain modulation through patient control is Corah's (1973) study of pedodontic patients and the effect upon their stress (see Table 11, Appendix A) of using a signaling device wherein a green light signified pain-but-go-ahead and a red light signified pain-with-

time-out-needed. The dentist paused treatment when the red light signal was given. Twenty-four subjects, aged six to eleven years, were randomly assigned to treatment or control group; the most significant measurement of stress was galvanic skin response (GSR), which is used experimentally as a measure of emotional arousal. Data analysis by ANOVA revealed significantly ($p < .05$) lower GSR in treatment versus control group, during the high arousal procedures of injection and high-speed drilling, and significantly ($p < .05$) higher GSR during low arousal procedures such as faculty-student conference, hand instrument preparation, and placing and carving amalgam.

Clinical implications of non-burn procedural research for burn patients. Clinically, one can hypothesize that the giving of control in threatening situations decreases patient arousal, which, according to Melzack and Dennis (1980), can decrease pain intensity by means of descending inhibitory control. The common practice of giving non-physical control to the burn patient during the dressing change in the form of time-outs (Watkins, 1993) is roughly analogous to the use of a signaling device. There is no evidence within burn literature for support of the practice, and Corah's (1973) study provides only parallel support, not unequivocal mandate.

Conclusions

Identification of Major Findings: Strengths and Weaknesses

Alternative topicals and skin substitutes. Alternative topicals and skin substitutes act at the level of peripheral small-fiber nociceptive afferents. The strength of the small-fiber nociceptor

studies is that they describe products or substances that do impact pain, either because they alter the frequency of or eliminate the need for dressing changes or because they provide an anesthetic. However, the weakness of the small-fiber nociceptor studies is that most are single studies of an intervention or product, not building on the others, and that within the group of small-fiber nociceptor afferent strategies, only topical creams and wound coverings have been investigated, not other strategies for altering perceived pain, such as comparisons between dressing change techniques (i.e., using different types of cloths for washing, comparing oscillating-water debridement with cloth-and-water debridement, comparing types of touch, with regard to direction, duration and firmness). No small-fiber nociceptor afferent strategy has been examined in an experimental fashion during the dressing change procedure, and no small-fiber nociceptor afferent studies of any type have examined the quality and technique of burn wound washing as they relate to patients' perceived pain.

TENS and acupuncture. TENS and acupuncture act at the level of peripheral large-fiber inhibitory afferents. The strength of the three peripheral large-fiber studies is that they are thorough descriptions of apparently effective interventions for control of burn pain. The three articles reviewed indicate that TENS and acupuncture are safe alternatives to opioids for post-procedural, baseline and possibly procedural pain control. Two of the studies were well-designed, using random assignment or two-period crossover, with patients as their own controls. Limitations of the

peripheral large-fiber strategy literature is that there are only three published research studies in burn literature, that no studies examine procedural burn pain, and that two studies examine the use of acupuncture or TENS at acupuncture sites, not well known or trusted in western nursing and medicine.

Systemic medications. Systemic medications act at the level of the central control trigger. The strength of the 18 systemic strategy studies is that they provide evidence for use of various opioids, an agonist-antagonist, an anxiolytic, an inhalation agent and a dissociative anesthetic as safe interventions in burn patients. With the exception of one preliminary PCA study, descriptive studies are precise and focused; quasi-experimental and experimental studies are well-controlled and well-conceived.

Despite no actual formal testing of efficacy, morphine and meperidine are widely used in treatment of burn pain (Perry & Heidrich, 1982). A weakness of the systemic group of studies is that research appears to be bound to single research sites. Some of the studies share a strategy, but three stand unreplicated: fentanyl, methadone pain cocktail, and the case study presenting high-dose morphine therapy. According to Perry and Heidrich (1982), of 181 burn units surveyed in the United States, only two-thirds used morphine or meperidine, raising the question of whether pain was in fact relieved at the other one-third of the units. There seems no universal standard of opioid use, even for procedural burn pain, in the United States. Studies surveying current use and supporting safe

use of morphine, meperidine, fentanyl and other opioids are notably lacking, representing an identified gap in the research literature.

Cognitive strategies. Cognitive strategies act at the level of descending inhibitory control, as they decrease anxiety or distract the burn patient's attention. Cognitive strategies comprise about one-third of the procedural burn pain control studies and contribute four baseline pain studies. Strengths of this segment are many. The two studies of spontaneously generated coping strategies are straightforward and clear. The case study of visual cueing is a fine example of creative application of theory to a clinical situation.

The eleven experimental and quasi-experimental studies represent a wide range in sophistication and design. In general, interventional strategies were clearly presented, so that they could easily be tested in other settings. Although evidence does not exist for the use of one specific purely cognitive strategy, there is evidence for the use of these strategies as a group: stress inoculation, teaching of coping strategies, relaxation, biofeedback, voluntary distraction, and behavior modification. These interventions are inexpensive and their use represents an independent nursing intervention. Limitations of the purely cognitive segment of studies relate principally to small sample size and to conceptualization and operationalization of variables. The mixed cognitive-peripheral segment of studies presents preliminary evidence for the effectiveness of patient-performed dressing changes in reducing pain. As with the purely cognitive studies, the intervention of involving the patient in washing burn wounds is inexpensive and is

an independent nursing intervention. Limitations of the mixed cognitive-peripheral segment of studies are small sample sizes in three of the four studies and use of observed pain behaviors rather than a pain scale for measurement of pain. The principal weakness of the cognitive strategy segment in general is that many fine researchers have examined related but distinct interventions and most have failed to define clearly or measure precisely the subjects' pain, certainly a compelling variable of great importance.

Identification of Gaps in the Literature

Many gaps in the literature exist. Several of the more interesting gaps include research that examines: the combination of small-fiber and large-fiber afferent firing that is the technique of washing the burn wound, procedural peripheral large-fiber (inhibitory) strategies such as TENS or acupuncture, differential pain relief using the systemic strategy of administration of various widely-used opioids both procedurally and post-procedurally, and the combined cognitive-peripheral strategy of provision of control through self-washing to adult burn patients. Despite various studies examining provision of control to burned children and the consequent effect upon observed pain and other measures, no researcher to date has examined the effect upon perceived procedural pain in adults that is produced by providing the patient control of burn wound washing.

CHAPTER III

METHODOLOGY

Methods

Research Design

This research used a single-subject repeated reversal design, incorporating a triangulated methodology. It is evident from the array of the research questions posed that a single method of data collection is insufficient.

Design utilized. The single-subject repeated reversal design (Campbell & Stanley, 1966) is named by Kratochwill (1978) the operant or ABAB design. In a single-subject repeated reversal design, each subject acts as his or her own perfectly matched control. There is a baseline measure, A, followed by a treatment measure, B, then a return to baseline, A, and another treatment measure, B, and so forth. Advantages of the single-subject repeated reversal design in pain research are provision of a perfectly matched control for study of a phenomenon that varies widely among subjects, and provision of sufficient subjects for data analysis when only a small sample is obtainable over a reasonable time period. Disadvantages of the design are its real or imagined stigma as quasi-experimental, and difficulty in interpretation if trending is present (Kratochwill, 1978).

Triangulation. Triangulation is a term used to describe the use of more than one data source, researcher, theory or method in order to obtain a more thorough impression of reality during the research process than would ordinarily be available (Denzin, 1970). Within nursing, triangulation as a methodological strategy is relatively new,

whereas triangulation has been advocated within the discipline of sociology for over thirty years (Denzin, 1970).

Originally, triangulation was a technique used by geodesy, the science of the measurement of the earth's surface (World Book Encyclopedia, 1953). It is employed by surveyors, for example, to determine the location of a distant point (a). For accurate determination to be made, the surveyor selects two other points, (b) and (c), from which (a) can be sighted. Sighting includes measurement of angles (b) and (c). Length b-c is measured. Using simple trigonometry, lengths b-a and c-a are computed and the location of (a) fixed.

Within sociology, the term methodological triangulation appears to have been popularized by Denzin (1970), although he credits Campbell (1963), Campbell and Fiske (1959), Webb (1966) and Webb, Campbell, Schwartz and Sechrest (1966) with earlier development of the concept of methodological triangulation for sociology. Nursing did not adopt methodological triangulation as a potential strategy until approximately ten years ago (Duffy, 1987; Hoeffer & Archbold, 1983; Porter, 1989; Sohier, 1988; Tripp-Reimer, 1985).

The use of methodological triangulation can provide a level of understanding of a phenomenon of interest that is not possible with use of a single method. Denzin's (1970) compelling argument for triangulation of method is the acquisition of enhanced validity, as one method compensates for the limitations of the other.

Within sociology, a methodologically triangulated study usually utilizes a principal method, with other methods serving as elaboration, clarification or counterpoint (Denzin, 1970). Within nursing, as well, triangulated studies have often stressed one method, with the other serving as preamble, illustration or explanation (Tripp-Reimer, 1985).

Methods of data collection utilized. For this research, the principal methods of data collection utilized were verbal numerical ratings of pain intensity by subjects; pen-and-pencil testing of subjects for pain descriptors, locus of control and mood state; interview of subjects, yielding verbal quantitative measures of patient preference; and interviews and observation employing the grounded theory method, whereby qualitative data were obtained from subjects and analyzed. Secondary methods of data collection were chart review for demographic data, chart review for quantitative data regarding medication administration, and verbal quantitative measures of washing adequacy obtained from staff nurses.

Research question 1-A-1:

1-A-1. Is there a difference in burn patients' pain intensity when PPW and NPW are compared?

was addressed quantitatively, using a verbal numerical rating scale, administered at regular intervals within each individual day's dressing change.

Research question 1-A-2:

1-A-2. Does the amount of pain medication administered differ on PPW versus NPW days?

was addressed by retrospective chart review.

Research question 2:

2. Do burn patients cleanse their burns as thoroughly as do nurses?

was addressed using a 0-to-4 Likert scale measure of adequacy administered to staff nurses after each day's dressing change washing.

Research questions 1-B and 3:

1-B. Is there a difference in burn patients' quality of pain when PPW and NPW are compared?

3. If patients differ in their responses to PPW and NPW in terms of pain intensity, pain quality or patient preference, do these differences relate to locus of control, mood state or demographics?

were addressed with survey-questionnaire methodology, using paper-and-pencil tests: the descriptor portion of the McGill Pain Questionnaire (MPQ) (Melzack, 1975) (Appendix B), the short-form Profile of Mood State (POMS) (Shacham, 1983) (Appendix C), and the Health Locus of Control (HLC) Scale (Wallston, Wallston, Kaplan & Maides, 1976) (Appendix D). Analysis of these instruments provided quantitative descriptive data. The MPQ was administered twice, once after a PPW, once after a NPW, and in no particular order. The short

form of the POMS and the HLC were administered as near the end of hospitalization as possible, and in no particular order.

Research question 1-C:

1-C. Which method, PPW or NPW, do patients prefer and why? was addressed using a 0-to-4 Likert scale measure of personal preference, administered during an interview near the end of hospitalization.

Research questions 1-D and 1-E:

1-D. Which method do subjects believe other patients should use and why?

1-E. What is the nature of dressing change pain as it relates to PPW and NPW?

were addressed by the grounded theory method, using a semi-structured open-ended interview developed by the investigator (Appendix E). The interview was conducted after all other data collection was complete. The interview was used to allow subjects to define what aspects of NPW and PPW were attractive or unattractive to them, what their styles were while performing the painful task of washing their own burns, what techniques of washing they preferred and why, what techniques they believed other subjects would benefit by using, and what the qualitative attributes of pain during NPW and PPW were. The interview schedule was used as a guide and subjects were allowed to elaborate freely, as they chose. As subjects were interviewed, themes were generated, and with subsequent subjects if the same themes did not arise, inquiries were made into these areas. Themes were coded, verified and analyzed

throughout data collection. Interviewing was also used to clarify subjects' quantitative and qualitative data and to try to explain apparently contradictory findings. Analysis of the interview data was made by use of the constant comparative method of qualitative analysis, as described by Glaser and Strauss (1967), in which data are coded and verified as collection proceeds, with review and analysis throughout the collection process. Grounded theory (Glaser & Strauss, 1967) is theory newly generated from data. An inductive process generates theoretical ideas, providing new connections and explanations about the phenomenon of interest.

Data Analysis and Interpretation

Verbal numerical rating scale. Data obtained by the verbal numerical rating scale were analyzed in two ways. Gentile, Roden and Klein (1972) have suggested the use of ANOVA for analysis of data obtained from the ABAB design. Repeated-measures ANOVA was used for each subject. Because Kratochwill (1978) stated that for ABAB and other time-series experimental designs the ANOVA has been inappropriately used and suggested use of visual data display in addition to statistical analysis, scatter graphs were constructed.

Amount of medication used. Amounts of medication administered on all days of data collection were converted to morphine equivalents (Jaffe & Martin, 1990). The Mann-Whitney U test was used to compare the amount of medication administered on NPW days with that administered on PPW days.

Likert scaling of thoroughness of washing, preference for NPW and preference for PPW. Likert scale values of thoroughness of

washing and of preference for NPW and for PPW were treated as ordinal data and analyzed nonparametrically. The Mann-Whitney U test was used to compare thoroughness of washing on NPW days versus PPW days. Spearman rank-order correlation was used to measure correlation between preference of NPW and preference of PPW, between preference of mode of washing and locus of control and between preference of mode of washing and mood state.

McGill Pain Questionnaire. Data obtained from the McGill Pain Questionnaire were treated descriptively by enumeration of frequency of responses. Pain rating indices and subscales of the McGill Pain Questionnaire were compared with numerical pain intensity measures, using Pearson product moment correlations.

HLC and POMS. Data obtained from the HLC were compared with Likert scaling of preference for NPW and for PPW, using Spearman rank-order correlation. Data obtained from the POMS, both the total score and the individual subscales, were compared with Likert scaling of preference for NPW and for PPW, also using Spearman rank-order correlation.

Research Setting

The setting was the burn unit of a 500-bed west-coast university hospital. Data were collected in the tubroom area and in patients' rooms.

Sample

A non-random sample of ten was selected from burn patients on the burn service, with dressing changes performed by career burn unit staff. Criteria for inclusion were: age of at least 15.5 years,

inpatient status, ability to wash at least some of one's own burns, ability to read and speak English fluently and ability to give informed consent. The exclusion criteria included the reverse of the above, in addition to status as a prisoner of the city, county, state or federal government.

Fifteen subjects were consented for the study. One refused to wash his own burns "ever" and was dropped after the first day of data-collection. Two subjects provided data for only two days and then went to surgery for grafting of their burns; due to the inability to obtain sufficient measures for analysis, their data could not be included. Another two subjects were discharged from the hospital before sufficient measures for analysis could be obtained. The remaining ten subjects were retained for data analysis.

Human Subjects Assurance

The Human Subjects Committees of the University of California, San Francisco and of the university operating the hospital at which the subjects were inpatients reviewed proposals for the study and gave approval. To protect subjects' anonymity, subjects were assigned numbers and will be referred to in this and in subsequent publications by number or by pseudonym. Subjects were informed that they could refuse to participate, that they could cease participation at any time, and that refusal to participate would have no effect upon their status as patients in the hospital. Subjects were assured that information received in the course of the study would be treated confidentially.

Data Collection Procedures

Although there are many meaningful points in time relative to the dressing change at which pain can be measured, and although it is possible to obtain either concurrent or retrospective measurements of burn pain, it was decided that concurrent procedural reported scores of pain intensity would be most useful and most meaningful in subsequent analyses.

Subjects were assigned to NPW for the first day of data collection. On subsequent days of data collection, subjects alternated between PPW and NPW. Subject 2 and Subject 5 requested and received an additional day of NPW before their first PPW. Subject 5's first day of data collection was discarded from analysis because of the extensive debridement performed, creating pain far in excess of the subsequent four days of data collection.

Dressing changes were performed in the tubroom area for most subjects. During times of high patient census, and when subjects were immobilized after grafting, dressing changes were performed in the subjects' hospital rooms. Location of the dressing change was maintained for the length of data collection in Subjects 1-8 and Subject 10. Subject 9's dressing changes occurred in his hospital room for the first two days of data collection, one NPW and one PPW day, and in the tubroom for the two subsequent days, one NPW and one PPW day.

Premedication was administered to all subjects on all days of data collection, based on the previous day's need for premedication. An exception to this was the premedication of Subject 5 with only

oral medication and no IV medication prior to a small PPW that did not involve graft takedown, and premedication of Subject 9 with only oral medication on Days 3 and 4, prior to his discharge on Day 4. Intraprocedural medication was administered by subject request, or at tubroom nurse initiative, often when verbalized pain scores reached the 9-to-10 range.

The dressing change consisted of removal of dressings, washing of burned areas with sterile sponges moistened with antibacterial soap and water, debridement of nonviable tissue and reapplication of topicals and dressings. On PPW days, subjects removed their dressings, as far as they were able, and washed their burns, insofar as they could. Subjects also soft-debrided or sharp-debrided devitalized tissue as far as they were able, using sponges, scissors, disposable tweezers, forceps and the Norsen debridement tool. On PPW days, subjects were allotted twice as much time for washing as was required by nurses washing the same areas on the previous day. Subjects all completed their washing well within the allotted time. When subjects had performed as much washing and debridement as they could perform, tubroom nurses completed washing and debridement of areas not attempted and, after a pause, of areas insufficiently complete by the subject. Then, fresh topicals and dressings were reapplied. On NPW days, nurses removed all dressings, washed all burns and redressed all wounds.

Pain intensity measures were made using a 0-to-10 verbal numerical rating scale. Patients were instructed to state the score that best represented their pain intensity, using any whole numbers,

mixed numbers, fractions or decimals they chose, from 0 to 10. Pain measures were collected at 30-second intervals, from removal of dressings through washing and redressing, under both PPW and NPW conditions.

The investigator was present for all dressing changes during which data were collected. A research assistant was present for some days of data collection. The nurse assigned to tubroom duty for the day was also present. The subject's bedside nurse was sometimes present, as well.

Pertinent subject comments related to pain that were made during the dressing change were noted and addressed as qualitative data.

Blind raters. Expectation of thoroughness of washing did not vary between PPW and NPW conditions. The tubroom nurse functioned as coach, pointing out areas of the burn that the subject had missed, often the back of the upper arm, the outside of the forearm or the outer aspect of the ankle. The subject could then choose to wash the designated area or to leave it for the nurse to wash later; subjects most frequently elected to self-wash in this instance. The nurse then washed areas not attempted by the subject.

At this point, an experienced burn nurse, not present for the dressing change and blind to that day's washing assignment, was brought to the room for inspection of wounds and ratings. Ratings were made on a 0-to-4 point Likert scale, by body areas, and were made by visual inspection; gloved palpation and attempted washing

and debridement by the rater were allowed but seldom employed. Rating criteria were:

4 - excellent washing and debridement of wounds, with no loose eschar, pseudoeschar, or nonviable tissue remaining

3 - very good washing and debridement of wounds, with less than 5% of loose eschar, pseudoeschar, or nonviable tissue remaining

2 - satisfactory washing and debridement of wounds, with 5 to 10% of the wound still covered by loose eschar, pseudoeschar, or nonviable tissue

1 - substandard washing and debridement of wounds, with 10 to 25% of the wound still covered by loose eschar, pseudoeschar, or nonviable tissue

0 - unsatisfactory washing and debridement of wounds, with more than 25% of the wound still covered by loose eschar, pseudoeschar, or nonviable tissue.

On NPW washing days, blind raters also were brought to the room and rated body areas in the same manner on the identical 0-to-4 point Likert scale. On both PPW and NPW days, ratings were communicated privately to the investigator or to the research assistant after completion of the dressing change.

Paper-and-pencil testing and interviews. Subjects were administered the descriptor portion of the short form of the McGill Pain Questionnaire (Melzack, 1975) by the investigator or the research assistant within half an hour of completion of the dressing change. Due to some subjects' overwhelming somnolence after dressing changes, the MPQ was administered within minutes of

completion of the washing portion of the dressing change, during an opportune pause, in the tubroom. Subjects who could use their hands completed the test using paper and pencil; subjects with hand burns were read the MPQ. Near the end of hospitalization, subjects completed the short-form of the POMS and the HLC. Again, subjects who could use their hands completed the forms using paper and pencil; subjects with hand burns were read the forms. An attempt was made with the MPQ, the short form of the POMS and the HLC to prop the test within visual range for patients who could not use a pencil and for the investigator to read the items aloud. After all data collection was complete, subjects were interviewed, in their hospital rooms.

Validity and Reliability

Design and Method Validity

Single-subject repeated reversal design. In using the single-subject repeated reversal design, there is a tradeoff made between two aspects of internal validity. Internal validity is enhanced by the use of subjects as their own controls, but history effect as a possible threat to internal validity exists due to non-concurrent data collection. Due to the intensely individualized nature of the pain experience, it was decided that the advantages of using subjects as their own controls far outweighed the potential disadvantages of a history effect.

External validity for the single-subject repeated reversal design is only as great as the variety of the individual subjects. In this study, use of a convenience sample of 10 subjects may or may

not have represented the variety in the underlying population; however, subjects were fairly catholic in that they were of both genders, were aged 24 through 65 years, and were burned over a range of 4 through 37.5% TBSA, with a variety of partial- and full-thickness injury. External validity for this study is also limited to the population from which the sample was drawn: that is, to patients in other burn units that employ similar methods of washing and debridement.

Survey-interview. The survey-interview methodology, using paper-and-pencil tests, such as the McGill Pain Questionnaire, the Health Locus of Control and the Profile of Mood State (short form), does not carry inherent risks to reliability and validity, but threats to reliability and validity may exist within the instruments themselves. However, inequality of method of testing can produce a decrease in validity of responses. For this study, subjects were all administered tests in a quiet room. If subjects could use their hands, they filled out the tests. If subjects could not use their hands, they were shown the tests as the investigator read the words aloud and marked the subjects' responses. Friends and family members were not present during administration of tests.

Grounded theory methodology. Grounded theory is intended to build rather than to test theory. Thus, threats to external and internal validity are not within the grounded theory methodology but may exist within the analysis of results that is the theory-building process.

In the course of theory-building, themes generated from interview data were classified into categories based upon components of the gate-and-coping framework (see Figure 2). Categories of peripheral input, central control, the gate control mechanism, descending inhibitory control, appraisal, problem-focused strategy, and emotion-focused strategy were used.

A second rater was used, a doctoral nursing student involved in pain research, to support the categorization of subject statements into the above seven categories. Interrater reliability was established by independent sorting of 95 statements into the seven categories by both the investigator and the second rater. Interrater agreement was initially 92%, with differences in sorting involving subject statements having components of more than one category. Ambiguous ratings were reexamined and discussed, with consensus reached as to which category the statements could most appropriately be assigned. Final interrater consensus was 100%. Several concepts central to dressing change pain were identified by the investigator and corroborated by the second rater. The investigator and the second rater discussed the incidence, distribution and importance of these concepts and agreed as to the concepts' meaning and significance within the context of dressing change pain.

Threats to reliability and validity may also exist within the instruments used: a semi-structured open-ended questionnaire constructed for this study and, to an extent, the researcher.

Instrument Reliability and Validity

The verbal numerical rating scale. Although the Visual Analogue Scale (VAS) is a commonly used and frequently studied scale used in clinical pain research, its reliability and validity for studies with burn patients have not been assessed. In general, the VAS has shown very high correlation between successive measures (Scott & Huskisson, 1979a; Scott & Huskisson, 1979b), with correlation coefficients as high as 0.99, supporting temporal reliability. An indirect support of validity of the VAS within the area of burn pain is the reported agreement between nurses' estimates of patients' pain and patients' report of their pain (Choiniere, Melzack, Girard, Rondeau & Paquin, 1990; Iafrati, 1986). Although agreement is modest, 31% absolute agreement, there is a general trend toward agreement of presence or absence of pain, with disagreement occurring as to amount of pain present, at least supporting the idea that pain is being measured and does exist in conditions under which experts expect pain to occur. The VAS, however, is used more frequently in measuring baseline and post-procedural burn pain than procedural burn pain, possibly due to logistical difficulties: it requires a certain level of visual acuity, and it requires that the patient mark a line on a scale, presumably both difficult and painful with undressed burns of the hands. The researcher must also be close to the subject, in order to hold the scale, an impossibility if the patient is being tubbed.

Clinically, therefore, use of the Verbal Numerical Rating Scale (VerbNRS) for measurement of procedural pain is preferable,

because it requires no equipment for the patient to manipulate, does not require a minimum level of visual acuity and allows the researcher to be near enough to the patient only to be heard, not seen. For these reasons the VerbNRS was selected for use in this study.

The 0-to-100 Verbal Numerical Rating Scale (VerbNRS) shows good correlation with the VAS, r = .86 (Kremer, Atkinson & Ignelzi, 1981), supporting reliability and validity of the VerbNRS. The VerbNRS is based on a continuous number scale and yields data which can be analyzed as a ratio scale (Stevens, 1946). Although the VerbNRS has shown a failure rate of 2% in one study (Kremer et al., 1981), it is easy to use and is widely used in a 0-to-10 form for assessment of acute pain intensity in emergency rooms, critical care areas and acute care wards, providing data for routine charting of pain levels and of results of pain medication administration. A VerbNRS deteriorates into a verbal categorical scale if the subject does not understand that the scale is a continuum and that all real numbers are possible responses. For this reason, subjects were instructed to select the whole number, mixed number, fraction or decimal that best represented their pain intensity, and subjects indeed chose whole numbers, mixed numbers and fractions in the course of data collection.

Additional support for use of the VerbNRS exists because the scale is so widely known and used in its 0-to-10 version (i.e., rating of pain in hospital situations, rating of affective warmth in product evaluation and hypothetical social contexts, rating of hazard and

disaster by television journalists) that its reliability and validity have probably been informally tested in virtually thousands of situations.

The Likert scale. The Likert scale is the most frequently used of the summated scales (McLaughlin & Marascuilo, 1990), scales that often layer gradation of response by use of descriptors such as never, seldom, moderately, frequently and always. Scoring of the layered descriptors is by means of ordinal numbers, and subsequent nonparametric analysis can therefore be utilized. The Likert scale has been found to be both reliable and valid (Likert, 1932).

The McGill Pain Questionnaire. The McGill Pain Questionnaire (MPQ) (Melzack, 1975) has been demonstrated to be both valid and reliable in measuring various pains: menstrual, arthritis, cancer, dental, back, phantom and post-herpetic (Melzack, 1975). Reliability is strongly supported by the correlation coefficient of 0.94 between pain rating index (PRI) and present pain intensity (PPI). Reliability within burn subjects is supported by Miller et al.'s (1992) finding of no significant differences in quality or intensity of pain measured by the McGill for control group (no intervention) subjects. Validity of the MPQ for measuring pain is supported by the derivation of the MPQ from subject-generated qualitative studies (Melzack & Torgerson, 1971) and by patients' comments relative to changes in their pain that were reflected in changes in both the PPI and the PRI (Melzack, 1975); patients' comments more often produced changes in the PRI, however, a more sensitive measurement within the MPQ of change in pain over time.

The MPQ has been used in both paper-and-pencil format and an interview format (Graham, Bond, Gerkovich & Cook, 1980; Klepac, Dowling, Rokke, Dodge & Schafer, 1981). Graham et al. (1980) inferred that the mode of administration in assessing cancer pain does not affect scores; Klepac et al. (1981) found that the mode of administration did affect scores in cold water pressor studies with student volunteers. It is not known whether there is a difference in MPQ scores in burn pain, dependent upon method of administration.

The Health Locus of Control Scale. The Health Locus of Control (HLC) Scale (Wallston et al., 1976) was developed in response to the difficulty in predicting behavior related to health and wellness issues using Rotter's (1966) Internal-External Locus of Control (I-E) Scale. Rotter's (1966) Internal-External Locus of Control (I-E) scale has established reliability and validity.

For health control issues, the HLC Scale was found to have small concurrent validity with Rotter's (1966) I-E scale, evidenced by a .33 correlation. The HLC Scale, however, differs substantively and is more able to predict health decisions, with p-values of .08 and .03 in two separate studies (Wallston et al., 1976) in which the I-E scale was unable to predict health decisions. Test-retest reliability for the HLC Scale with an 8-week interval was found to be .71.

The Profile of Mood States (shortened form). The short form of the Profile of Mood States (POMS) (Shacham, 1983) was derived from the POMS (McNair, Lorr & Droppleman, 1971), using a computer program that retained and eliminated items of the original POMS, based on contribution to internal consistency (Crohnbach's alpha) and

the face validity of the items. When tested with 83 cancer patients, the internal consistency remained unchanged or improved slightly, as compared with the POMS, within each of the six scales. When compared with the POMS, the short form of the POMS has the advantage of a shortened time of administration (3-7 minutes versus 15-20 minutes) and fewer items (37 versus 65).

The semi-structured open-ended interview. In the semi-structured open-ended interview (Appendix E), content validity of the questions related to preference of NPW versus PPW is supported by research with burn patients (Tarnowski et al., 1987), as are questions related to styles of washing (Savedra, 1976) and to feelings experienced in the course of one type of washing or another (Choiniere et al., 1989).

Reliability of the interview is indirectly supported by subjects' reiteration during the course of the interview, or at the end of the interview when they were asked if there was anything else they wanted to add, of their preferences related to NPW versus PPW and of the aspects of PPW or of NPW that they especially preferred or did not prefer.

CHAPTER 4

RESULTS

This chapter describes the subject population and presents quantitative and qualitative findings. It also provides data to support the study's internal validity and to attempt to explain interindividual variations in relation to the primary research questions.

Description of Sample

The subjects retained for data analysis (see Table 12)

Table 12

Physical Demographics

Subject Number	Age	% Burn	% F-T Burn	Graftings	Days In Hospital	Cause of Burn
1	25	16	0	0	7	Flame
2	35	16.5	0	0	8	Explosion
3	34	6	1	1	9	Contact
4	65	37.5	30.5	2	49	Flame
5	35	5	1.5	1	7	Explosion
6	48	17	0	0	6	Explosion
7	37	27	10	1	13	Flame
8	24	18.5	8.5	1	10	Flame
9	38	16	0	0	4	Flame
10	35	32	10	1	16	Flame

represented a variety of ages, genders, percentage of burn and cause of injury. The ten subjects' mean age was 37.60 years, with a standard deviation of 11.721 and a range of 24 to 65. Subjects' mean percentage of burn was 19.15% TBSA, with a standard deviation of 10.374 and a range from 5 to 37.5%. Mean percentage of full-thickness burn was 6.15% TBSA, with a standard deviation of 9.589 and a range from 0 to 30.5%. Number of surgeries for skin grafting ranged from 0 to 2, with a mean of 0.70 and a standard deviation of 0.675. Cause of burns included one contact, six flame and three explosion injuries.

Social demographics (see Table 13) included marital status, employment status, birth order and history of substance abuse. Of the ten subjects, four were married, three were divorced, two were single and one was widowed. Six subjects were employed, four were not. Of the four unemployed subjects, two were on permanent medical disability. Three subjects were only children, one was an eldest, five were middle children and one was a youngest but a youngest with a nine-year interval between himself and his next sibling, giving him more of the characteristics of an only child (Toman, 1969). Of the ten subjects, six had negative histories for substance and alcohol abuse, one had a past history of both alcohol and substance abuse, one had a past history of alcohol abuse, and one had a past history of substance abuse. At the time of the injury, however, only one subject reported current substance and alcohol abuse: heroin addiction and a daily consumption of 8 ounces of alcoholic spirits. He was also homeless and was one of the four

unemployed subjects.

Table 13

Social Demographics

Subject Number	Marital Status	Number of Children	Employment Status	Birth Order	Substance History
1	Single	0	Unemployed	1 of 1	Negative
2	Married	4	Employed	3 of 5	Negative
3	Divorced	1	Unemployed	1 of 7	Drugs
4	Widowed	1	Unemployed	1 of 1	Alcohol
5	Divorced	1	Employed	2 of 3	Negative
6	Married	5	Employed	6 of 6	Negative
7	Married	2	Employed	5 of 9	Drugs, alcohol
8	Single	0	Employed	3 of 4	Negative
9	Divorced	1	Unemployed	1 of 1	Drugs, alcohol
10	Married	3	Employed	7 of 9	Negative

Quantitative Findings

Pain Intensity Scores

Subjects' pain intensity during dressing change washing for all days of NPW and PPW (see Table 14) rated on a continuous verbal numerical scale of 0 to 10 ranged from 0 to 10, for subjects as a group. Pain intensity scores were obtained near the beginning of hospitalization for some subjects and near the end of hospitalization for others, after large open areas had been grafted, producing lower pain scores in the latter subjects. The most frequently named pain

Table 14

Pain Intensity Scores On All Days of NPW and PPW Dressing Changes

Subject	1	2	3	4	5	6	7	8	9	10	Mean
Low Pain Score	5	5	4	0	1	4	0	0	0	0	1.9
High Pain Score	10	10	10	10	5	10	5	10	10	10	9.0

Table 15

Frequency Distribution of All Pain Intensity Scores

Score	Frequency	Cumulative Frequency	Cumulative Relative Frequency
10	55	394	1.0000
9.75	5	339	0.8604
9.5	24	334	0.8477
9	37	310	0.7868
8.75	9	273	0.6929
8.5	11	264	0.6701
8	29	253	0.6421
7.75	1	224	0.5685
7.5	51	223	0.5660
7	34	172	0.4365
6.5	10	138	0.3503
6	6	128	0.3249
5.5	2	122	0.3096
5	36	120	0.3046
4.5	12	84	0.2132
4	30	72	0.1827
3.5	1	42	0.1066
3	5	41	0.1041
2	8	36	0.0914
1	3	28	0.0711
0.5	2	25	0.0635
0	23	23	0.0584

Table 16

Pain Intensity Scores During NPW

Subject	1	2	3	4	5	6	7	8	9	10	Mean
Low Pain Score	5	5	4	7	3	4.5	0.5	5	7	4	4.5
High Pain Score	10	10	10	10	5	10	5	10	10	10	9.0

Table 17

Frequency Distribution of NPW Scores

Score	Frequency	Cumulative Frequency	Cumulative Relative Frequency
10	54	211	1.0000
9.75	5	157	0.7441
9.5	24	152	0.7204
9	32	128	0.6066
8.75	3	96	0.4550
8.5	6	93	0.4408
8	21	87	0.4123
7.5	7	66	0.3128
7	20	59	0.2796
6.5	3	39	0.1848
6	6	36	0.1706
5.5	1	30	0.1422
5	17	29	0.1374
4.5	2	12	0.0569
4	5	10	0.0474
3	1	5	0.0237
2	2	4	0.0190
1	1	2	0.0095
0.5	1	1	0.0047
0	0	0	0.0000

Table 18

Pain Intensity Scores During PPW

Subject	1	2	3	4	5	6	7	8	9	10	Mean
Low Pain Score	6.5	5.5	4	0	1	4	0	0	3	0	2.4
High Pain Score	9	9	5	9	4	10	1	5	8	5	6.5

Table 19

Frequency Distribution of PPW Scores

Score	Frequency	Cumulative Frequency	Cumulative Relative Frequency
10	1	183	1.0000
9	5	182	0.9945
8.75	6	177	0.9672
8.5	5	171	0.9344
8	8	166	0.9071
7.75	1	158	0.8634
7.5	44	157	0.8579
7	14	113	0.6175
6.5	7	99	0.5410
5.5	1	92	0.5027
5	19	91	0.4973
4.5	10	72	0.3934
4	25	62	0.3388
3.5	1	37	0.2022
3	4	36	0.1967
2	6	32	0.1749
1	2	26	0.1421
0.5	1	24	0.1311
0	23	23	0.1257

score during dressing change washing for all days of NPW and PPW was 10 (see Table 15), with a mean of 6.84. Pain intensity scores during NPW (see Table 16) ranged from 0.5 to 10 but were never zero. The overall mean of all NPW pain scores was 8.18 The most frequently named pain score for NPW was 10 (see Table 17). Pain intensity scores during PPW ranged from 0 to 10 (see Table 18), with only one 10 recorded (see Table 19). The overall mean of all PPW pain scores was 5.30. The most frequently selected pain score for PPW was 7.5.

Comparison of pain intensity scores for NPW versus PPW. The null hypothesis that there would be no significant difference in pain intensity scores under conditions of NPW versus PPW was rejected. Pain intensity scores differed significantly among days of data collection in all ten subjects (see Table 20), by repeated-measures ANOVA, performed on each subject individually, with p-values ranging from $< .001$ through $< .05$. Secondary Scheffé analysis demonstrated that NPW pain scores differed significantly from PPW scores for all subjects; levels of significance were the same at the levels at which the ANOVAs were significant, with the exception of one subject. For Subject 9, pain scores differed at the $p < .01$ level, but NPW days differed from PPW days by secondary analysis at the level of $p < .05$. In all ten subjects, mean pain scores for NPW days were greater than mean pain scores for PPW days (see Table 21).

Visual display. In the interests of clarity, visual display is presented, in addition to ANOVA results, for the variable of mean pain intensity. Display of raw daily mean pain intensity scores for

Table 20

Pain Intensity Score Analysis

Subject	1	2	3	4	5	6	7	8	9	10
ANOVA	.05	.001	.005	.001	.001	.001	.005	.001	.01	.001
Scheffé	.05	.001	.005	.001	.001	.001	.005	.001	.05	.001
NPW Mean Pain	8.5	8.8	7.6	8.8	4.4	8.6	3.2	7.2	9.5	8.1
PPW Mean Pain	7.3	7.6	4.3	3.8	2.3	6.0	0.2	1.0	6.8	3.6

Table 21

Mean Pain Scores By Subject By Day By Type of Washing

Subject	1	2	3	4	5	6	7	8	9	10
Day 0 * (NPW)		8.5								
Day 1 (NPW)	8.2	8.4	6.4	8.5	5.0	8.6	2.9	7.2	10	7.2
Day 2 (PPW)	7.3	7.5	4.7	2.5	3.0	7.8	0.3	1.7	7.2	4.6
Day 3 (NPW)	8.8	9.3	8.9	9.1	3.8	8.5	3.5	7.2	9.0	9.1
Day 4 (PPW)		7.7	4.0	5.2	1.7	4.2	0.0	0.4	6.4	2.6

* Represents an additional day of NPW before first reversal to PPW

Figures 4, 5, 6 and 7

Raw and Detrended Mean Pain Scores for Subjects 1 and 2

Subject 1

Figure 4

Raw Data

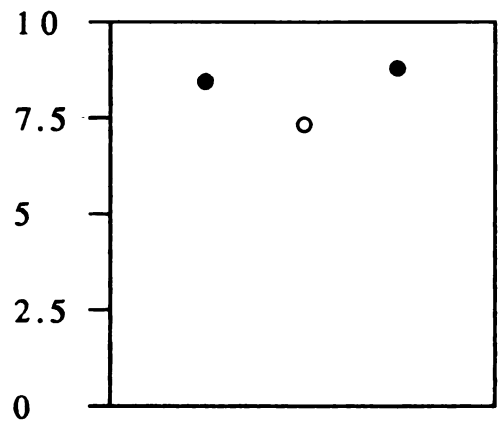
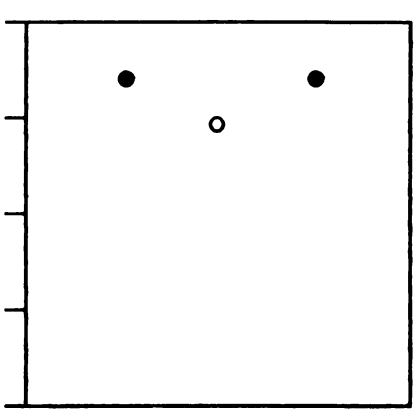


Figure 5

Detrended Data



Subject 2

Figure 6

Raw Data

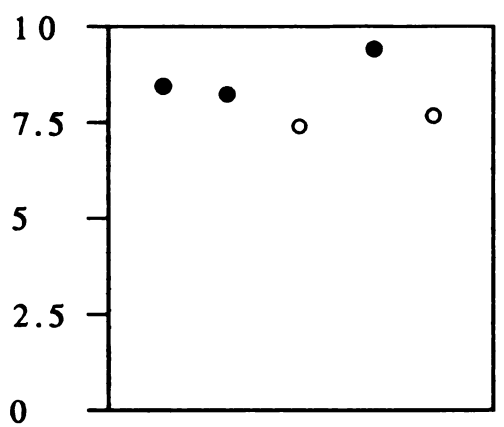
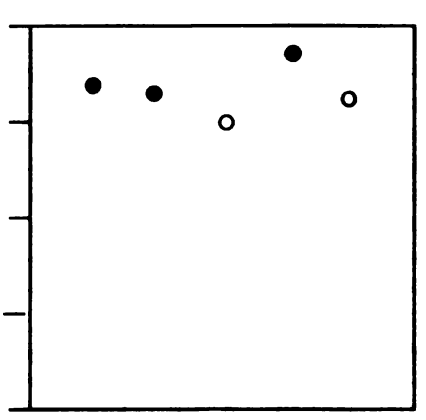


Figure 7

Detrended Data



● designates NPW

○ designates PPW

Figures 8, 9, 10 and 11

Raw and Detrended Mean Pain Scores for Subjects 3 and 4

Subject 3

Figure 8

Raw Data

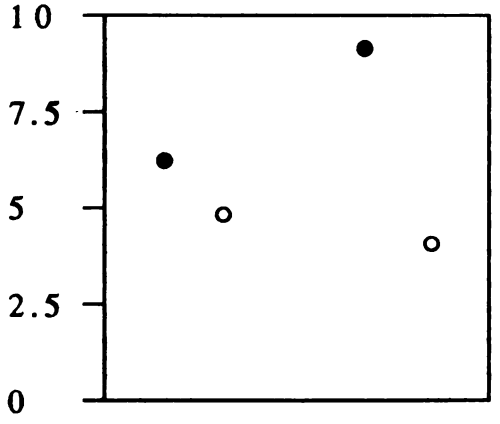
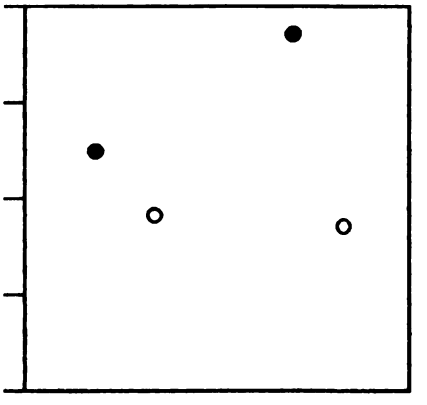


Figure 9

Detrended Data



Subject 4

Figure 10

Raw Data

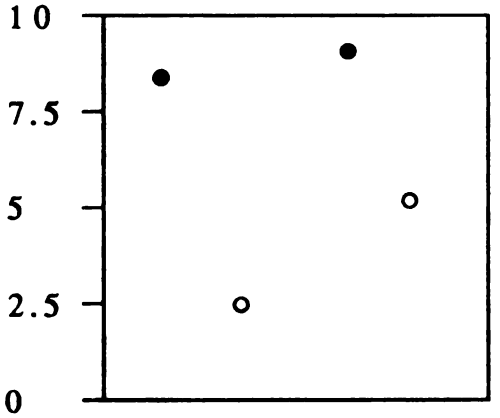
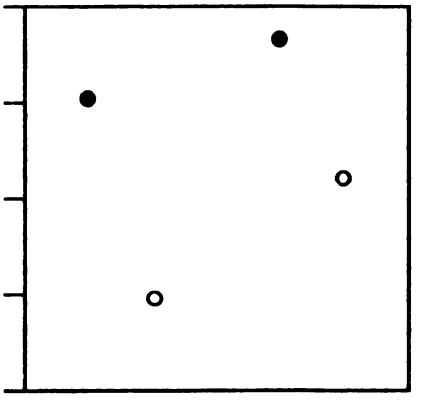


Figure 11

Detrended Data



● designates NPW

○ designates PPW

Figures 12, 13, 14 and 15

Raw and Detrended Mean Pain Scores for Subjects 5 and 6

Subject 5

Figure 12

Raw Data

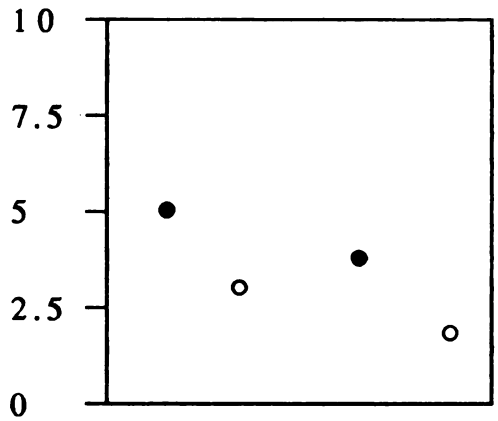
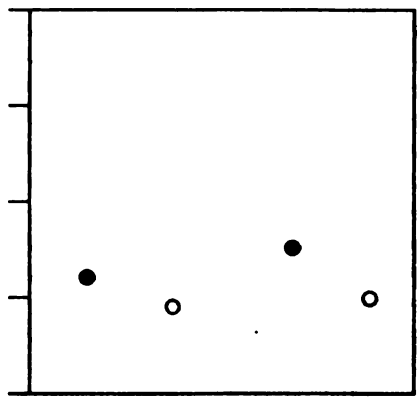


Figure 13

Detrended Data



Subject 6

Figure 14

Raw Data

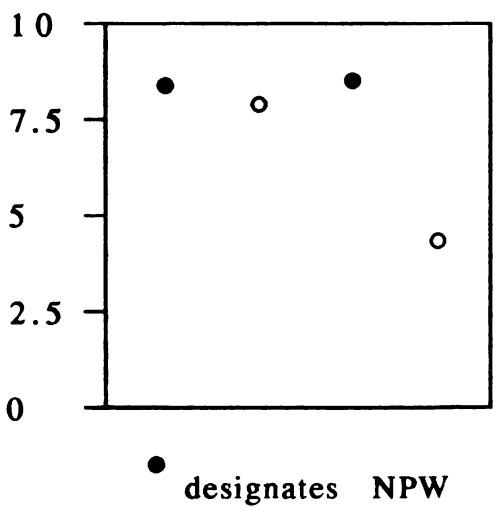
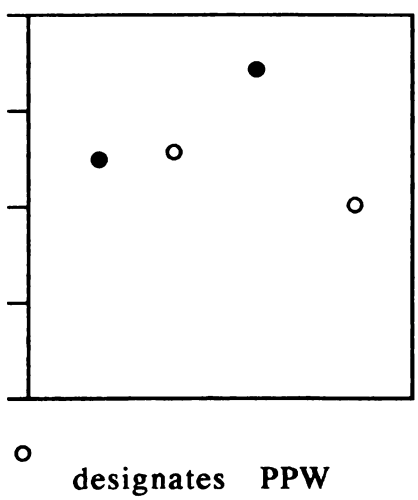


Figure 15

Detrended Data



Figures 16, 17, 18 and 19

Raw and Detrended Mean Pain Scores for Subjects 7 and 8

Subject 7

Figure 16

Raw Data

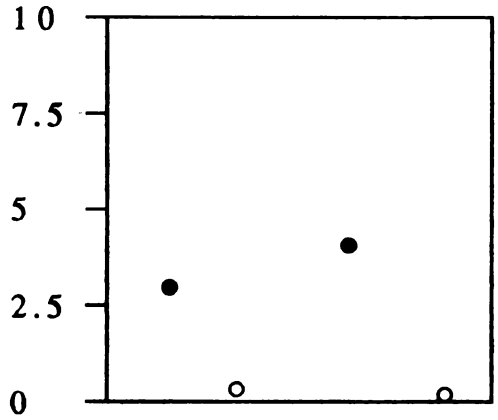
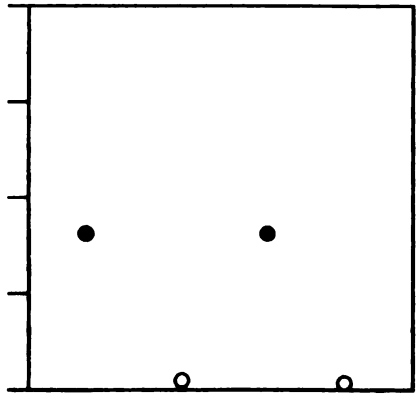


Figure 17

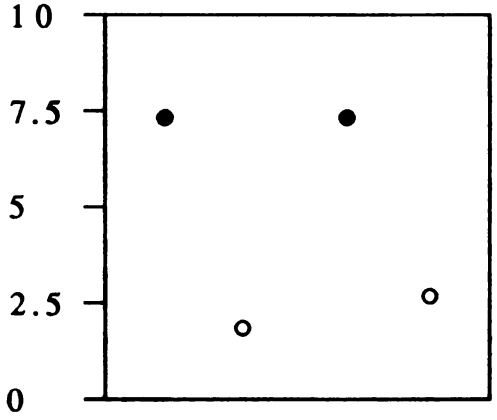
Detrended Data



Subject 8

Figure 18

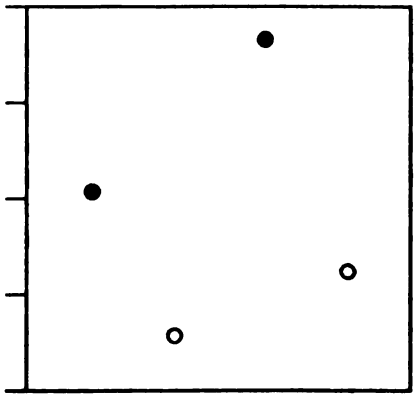
Raw Data



● designates NPW

Figure 19

Detrended Data



○ designates PPW

Figures 20, 21, 22 and 23

Raw and Detrended Mean Pain Scores for Subjects 9 and 10

Subject 9

Figure 20

Raw Data

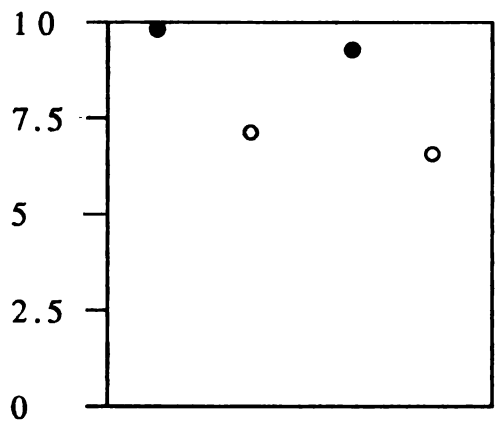
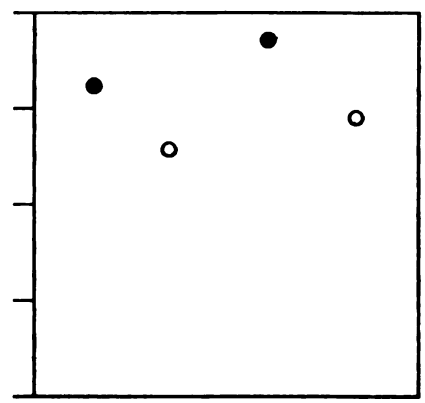


Figure 21

Detrended Data



Subject 10

Figure 22

Raw Data

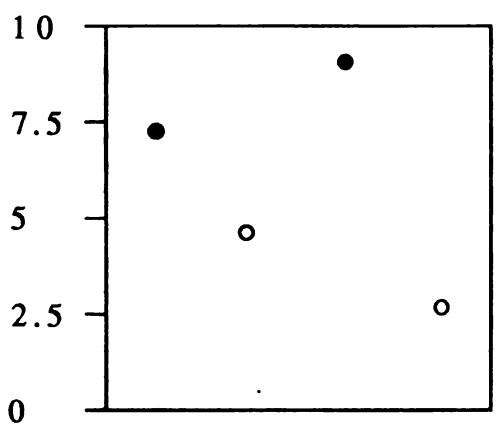
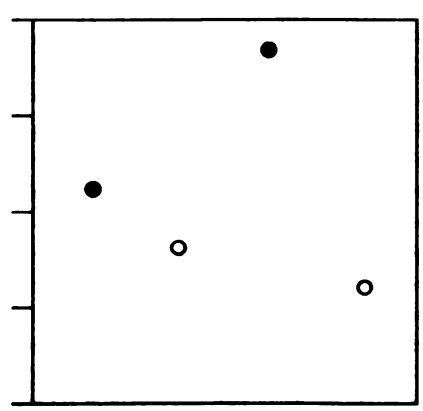


Figure 23

Detrended Data



● designates NPW

○ designates PPW

each subject demonstrates a visible difference between NPW and PPW (see Figures 4, 6, 8, 10, 12, 14, 16, 18, 20, and 22), with values for NPW scores greater than values for PPW scores for each individual subject.

Detrended data represent data artificially altered, according to a linear regression formula, to better represent the variable of interest as it relates to the independent variable. Normally, sequential data may vary according to both the independent variable and another variable that demonstrates a predictable direction over time. Kratochwill (1978) has commented that there is a difficulty in interpreting the results of the ABAB design if trending is present.

In the case of daily mean pain intensity scores, the degree of trending present is determined by deriving a linear regression formula for each subject, using daily mean pain intensity scores to represent y and the dummy variable of time, coded by whole integers ranging from -2 to +2, as x. The regression formula can then be used to determine a value of "y-calculated" for every x-point. Division of the observed daily mean pain score (y) by the predicted daily mean pain score (y-calculated) effectively detrends the variable. Multiplication of the quotient [y divided by y-calculated] by y-calculated when x equals zero, normalizes the detrended values for graphical display (see Tables 22 and 23). Analysis of individual regression values by ANOVA provides testing for statistical significance. An amount of trending appears to be present for all subjects, but for no subject was the amount of variance due to trending statistically significant (see Table 24). The direction of

Table 22

Raw and Detrended Data Points for Subjects 1 Through 7

Subject	Type of Washing	Raw Daily Mean Pain Scores	Detrended Daily Mean Pain Scores
1	NPW	8.214	8.522
	PPW	7.333	7.333
	NPW	8.800	8.497
2	NPW	8.528	8.402
	NPW	8.357	8.295
	PPW	7.456	7.456
	NPW	9.310	9.380
	PPW	7.740	7.858
3	NPW	6.350	6.247
	PPW	4.667	4.629
	NPW	8.875	8.949
	PPW	4.000	4.067
4	NPW	8.500	7.643
	PPW	2.500	2.367
	NPW	9.062	9.062
	PPW	5.167	5.473
5	NPW	5.000	3.049
	PPW	3.000	2.273
	NPW	3.750	3.750
	PPW	1.667	2.450
6	NPW	8.600	6.246
	PPW	7.800	6.563
	NPW	8.542	8.542
	PPW	4.174	5.143
7	NPW	2.875	1.618
	PPW	0.300	0.216
	NPW	3.500	3.500
	PPW	0.000	0.000

Table 23

Raw and Detrended Data Points for Subjects 8 Through 10

Subject	Type of Washing	Raw Daily Mean Pain Scores	Detrended Daily Mean Pain Scores
8	NPW	7.250	5.197
	PPW	1.667	1.392
	NPW	7.250	9.035
	PPW	0.375	0.620
9	NPW	10.00	8.090
	PPW	7.200	6.440
	NPW	9.000	9.000
	PPW	6.375	7.228
10	NPW	7.200	5.358
	PPW	4.562	3.893
	NPW	9.083	9.083
	PPW	2.600	3.140

Table 24

Variance Ratio Representing Contribution of Amounts of Trending Present in Raw Mean Pain Scores to Total Variance

Subject	1	2	3	4	5	6	7	8	9	10
Variance Ratio	0.19	0.06	0.00	0.04	5.49	2.91	0.37	0.40	2.02	0.43
Signi-ficance	> .10	> .10	> .10	> .10	> .10	> .10	> .10	> .10	> .10	> .10

trending is toward a decrease in pain scores for all subjects except Subject 1; Subject 1's trend is in a positive direction over time.

Visual display confirms that for all data points except the first day of PPW for Subject 6, detrended data points for PPW are exceeded in magnitude by the detrended data points for NPW (see Figures 5, 7, 9, 11, 13, 15, 17, 19, 21 and 23).

McGill Pain Questionnaire

The McGill Pain Questionnaire (MPQ) can be interpreted quantitatively in terms of both magnitude of pain intensity and descriptors of pain quality. Interpretation of the MPQ in terms of pain magnitude involves summing the various descriptors as a whole, yielding the Pain Rating Index (PRI), and within subscales, yielding sensory, affective, evaluative and miscellaneous totals. Interpretation of the MPQ related to pain quality is made by observing the frequencies with which the various descriptors are used. Frequent use of a given descriptor for a painful experience implies that the experience can be characterized by that descriptive adjective.

Pain intensity data. The twenty MPQs completed by the study's ten subjects yielded PRIs (see Table 25) ranging from 4 through 58, with a mean of 30 and a standard deviation of 14. Within the group of MPQs completed after NPW dressing changes, the range was 16 through 58, with a mean of 36 and a standard deviation of 14. Within the group of MPQs completed after PPW dressing changes, the range was 4 through 41, with a mean of 24 and a standard deviation of 13.

PRIs were greater for NPW than for PPW in seven of the ten subjects. Differences between PRIs in these seven subjects ranged

Table 25

Pain Rating Index of NPW Versus PPW

Subject	1	2	3	4	5	6	7	8	9	10
PRI for NPW	18	42	36	58	28	38	27	16	52	47
PRI for PPW	26	25	41	31	7	22	4	16	39	34
NPW Minus PPW PRI	-8	17	-5	27	21	16	23	0	13	13

from 13 to 27. PRIs were greater for PPW than for NPW in two of the seven subjects. Differences between PRIs in these two subjects ranged from 5 to 8. The PRI was the same for PPW and for NPW in one subject. Because of the substantial contribution of sensory words to the total PRI (see Table 26), the type of washing receiving the greater PRI received a greater sensory subscale score as well.

Correlations of pain intensity scores with the MPQ. The MPQ's PRI did not correlate significantly with subjects' mean pain intensity scores within NPW and PPW conditions, as a whole (see Table 27), although there was a weak correlation ($p < .10$) between mean pain intensity on all days of NPW and the MPQ's PRI. Neither was the PRI significantly correlated with the mean pain score on the single day the MPQ was completed.

The evaluative subscale of the MPQ, however, correlated well

Table 26

McGill Subscales for NPW Versus PPW

Subject	1	2	3	4	5	6	7	8	9	10
Sensory										
NPW	13	26	19	31	13	28	15	11	26	23
PPW	17	13	28	14	7	10	3	12	16	17
Affective										
NPW	0	3	4	13	7	3	1	0	6	8
PPW	1	2	2	6	0	3	0	4	4	8
Evaluative										
NPW	4	4	3	5	4	3	0	1	5	5
PPW	4	3	2	3	0	4	0	0	5	1
Miscel-laneous										
NPW	1	9	10	9	4	6	11	4	15	11
PPW	4	7	9	8	0	5	1	0	14	8

with subjects' mean pain intensity scores, especially for PPW. The evaluative subscale correlated significantly ($p < .001$) with pain scores both on its respective PPW day of data collection and on PPW days taken as a group. The evaluative subscale correlated significantly with pain scores on NPW days considered as a group ($p < .05$) but correlated only weakly and nonsignificantly with pain intensity scores obtained on the day of data collection that produced the individual MPQ.

Sensory, affective and miscellaneous subscales were not significantly correlated with mean pain scores. However, nonsignificant weak correlations ($p < .10$) existed between the sensory subscale of the MPQ and both single and grouped days' mean

Table 27

Pearson Product Moment Correlations of MPQ PRI and MPQ Subscales with Pain Intensity Scores

	Single Day's Mean Pain Intensity Score	Combined Mean Pain Intensity Score
NPW		
PRI	.4158 (NS)	.4918 (NS)
Sensory	.5699 ($p < .10$)	.6207 ($p < .10$)
Affective	.1418 (NS)	.2144 (NS)
Evaluative	.5517 ($p < .10$)	.6465 ($p < .05$)
Miscellaneous	.0707 (NS)	.1303 (NS)
PPW		
PRI	.4617 (NS)	.5933 ($p < .10$)
Sensory	.2803 (NS)	.4296 (NS)
Affective	.0117 (NS)	.0520 (NS)
Evaluative	.9032 ($p < .001$)	.8873 ($p < .001$)
Miscellaneous	.4920 (NS)	.5840 ($p < .10$)

pain intensity scores for NPW, and between the miscellaneous subscale and grouped days' mean pain intensity scores for PPW.

Data related to pain quality. Certain MPQ descriptors were chosen to define procedural pain, in general, more frequently than were others (see Table 28). The descriptors most frequently selected were exhausting, stinging, sharp, tender, piercing, wrenching, burning, hurting, sickening, fearful, tight and tearing. Also selected frequently were throbbing, jumping, pricking, searing, aching, intense, cool and dreadful. Selected four times each were shooting, smarting, heavy, punishing, wretched, miserable and unbearable.

Table 28

Frequency of Selection of Descriptors for Procedural Pain in General

12 Times	10 Times	7 Times	6 Times
Exhausting	Stinging	Sharp	Wrenching
		Tender	Burning
		Piercing	Hurting
			Sickening
5 Times		4 Times	Fearful
			Tight
Throbbing	Jumping	Shooting	Smarting	Tearing
Pricking	Searing	Heavy	Punishing	
Aching	Intense	Wretched	Miserable	
Cool	Dreadful	Unbearable		

Descriptors not selected were cramping, splitting, killing, spreading and numb.

Descriptors used to describe NPW (see Table 29) were 61 of the 78 available. Most frequently selected were stinging, exhausting,

Table 29

Frequency of Selection of Descriptors for NPW Pain

7 Times	4 Times		3 Times	
Stinging	Shooting	Sharp	Throbbing	Burning
	Wrenching	Searing	Tender	Punishing
5 Times	Hurting	Sickening	Intense	Unbearable
	Fearful	Tearing	Tight	Cool
Exhausting			Dreadful	
Piercing				

piercing, shooting, sharp, wrenching, searing, hurting, sickening, fearful and tearing. Throbbing, burning, tender, punishing, intense, unbearable, tight, cool and dreadful were selected three times each. Descriptors used to define PPW (see Table 30) were 56 of the 78

Table 30

Frequency of Selection of Descriptors for PPW Pain

7 Times	4 Times		3 Times	
Exhausting	Jumping	Tender	Pricking	Sharp
			Burning	Stinging
			Aching	Radiating
			Tight	

available. Most frequently selected were exhausting, jumping and tender. Pricking, sharp, burning, stinging, aching, radiating and tight were each selected three times.

It appears that NPW procedural pain is similar in quality to PPW in that they are both exhausting, tender, stinging, sharp, burning and tight. NPW seems to differ from PPW in that NPW produces pain that is more piercing, shooting, wrenching, searing, hurting, sickening, fearful, tearing, throbbing, punishing, intense, unbearable, cool and dreadful. PPW seems to differ from NPW in that PPW produces pain that is more jumping, pricking, aching and radiating.

The only descriptors used by half or more than half of the subjects were exhausting for both NPW and PPW pain, and piercing and stinging for NPW pain.

Quantifiable Interview Data

Preference for NPW or PPW and advice to a friend. Subjects did not unequivocally prefer PPW, nor did they uniformly express the opinion that a hypothetical burned friend should elect PPW.

There was failure to reject the null hypothesis that if subjects displayed a significant difference in pain intensity scores, with PPW less painful than NPW, they would not necesssarily prefer PPW. Although PPW produced significantly lower pain scores for all subjects, they were divided in their preference for NPW or PPW, rated on a 0-to-4 point Likert scale (see Table 31), with only seven subjects preferring PPW. Likert ratings for NPW and PPW were significantly and negatively intercorrelated (r_s = - .8381, $p < .005$).

Qualifications of the stated preferences were elicited. Subject 2 qualified his preference of PPW, stating that when he needed two dressing changes a day he preferred PPW for the first (day shift)

Table 31

Subject Preference for NPW or PPW

Subject	1	2	3	4	5	6	7	8	9	10
Likert Rating for NPW	4	1	4	0	0	2	0	2	0	1
Likert Rating for PPW	1.5	3	0.5	4	4	4	4	2	4	3
Preference	NPW	PPW	NPW	PPW	PPW	PPW	PPW	None	PPW	PPW

dressing change and NPW when a second change of the day needed to be performed in the evening, because of his exhaustion. Subject 8 expressed a mixed preference, stating that he preferred PPW for his face, neck and jaw burns and NPW for the more painful areas, his arm and chest.

Frequency of self-washing appeared to impact subjects' preference for PPW. Subjects 1 and 3 washed their own burns only during PPW data-collection dressing changes. Subjects 4, 6 and 10 washed their burns at least three times each. Subjects 2, 5, 7, 8 and 9 had face burns as well as burns of the extremities and performed their own face care at night shift dressing changes and at non-data-collection day shift dressing changes. The number of times the subject washed any burned areas, including the face, showed a weak negative correlation (r_s = -.4438, $p < .10$) with Likert scale preference scores for NPW. Number of times the subject self-washed was not significantly correlated with preference scores for PPW (r_s = .2908).

Five of the ten subjects unequivocally expressed the opinion that if a friend were a burn patient, they would advise him to choose PPW over NPW. Three subjects would advise friends to try PPW and see how it worked for them. One subject would advise a friend to try PPW for "reachable" areas but to let the nurses perform NPW for leg burns. One subject would advise a friend to select NPW under any circumstances.

Findings That Impact the Study's Internal Validity

Adequacy of washing. There was failure to reject the null hypothesis that there was no difference in washing adequacy when

burn patients and nurses were compared. Adequacy of washing for both NPW and PPW was evaluated by blind raters who classified the washing for the day on a 0-to-4 point Likert scale (see Table 32). Results were analyzed using the Mann-Whitney U test. There was found to be no significant difference between ratings of NPW and PPW days for any of the subjects ($p < .05$).

Table 32

Adequacy of Washing

Subject	1	2	3	4	5	6	7	8	9	10
NPW Scores	3,3	4,3,3	3,4	3,3	4,4	3,3	4,4	3,3	4,4	4,4
PPW Scores	3	3,3	3,4	3,3	4,4	3,3	4,4	3,3	4,4	3,4

Pain medication administration. Opioid analgesics administered on all data-collection days were converted to morphine equivalents, using Goodman and Gilman's The Pharmacological Basis of Therapeutics (Jaffe & Martin, 1990). (Jaffe and Martin have observed, however, that oxycodone and hydrocodone are appropriate medications for moderate pain and may not be equivalent to sub-cutaneous morphine.) Amounts of medication administered during various time intervals and timing of intraprocedural medication increments were addressed.

The total in morphine equivalents was compared with respect to amounts administered for three time intervals: during dressing

changes, for the 4 hours beginning with each dressing change, and for the time beginning with each dressing change and ending with the next dressing change (see Table 33). Results were analyzed using

Table 33

Opioid Pain Medication Administration in Morphine-Equivalents

Subject	Type of Dressing Change	During Dressing Change	Dressing Change Plus Four Hours	Dressing Change To Next Dressing Change
1	NPW	20, 20	30, 30	40, 50
	PPW	2 0	2 0	4 0
2	NPW	20, 20, 36	20, 30, 46	40, 50, 66
	PPW	20, 30	30, 40	50, 60
3	NPW	8, 16	18, 16	28, 36
	PPW	12, 5	12, 10	42, 45
4	NPW	4, 11	4, 14	7, 17
	PPW	10, 6	10, 8	10, 16
5	NPW	3, 8	18, 8	56, 28
	PPW	10, 6	10, 16	40, 26
6	NPW	16, 16	31, 26	56, 28
	PPW	20, 16	37, 18	43, 29
7	NPW	10, 4	20, 4	20, 4
	PPW	30, 10	40, 10	40, 10
8	NPW	16, 26	16, 26	26, 48
	PPW	14, 8	24, 18	46, 48
9	NPW	16, 10	20, 10	20, 10
	PPW	30, 10	30, 10	50, 10
1 0	NPW	12, 10	22, 24	42, 46
	PPW	26, 24	26, 36	46, 50

the Mann-Whitney U test. Amount of medication administered did not differ significantly by subject ($p > .10$; $p > .10$; $p > .10$) or across subjects ($p = .2843$; $p = .4960$; $p = .2877$).

Descriptively, it was noted that when IV medication was titrated over the course of the dressing change, the pattern of medication administration varied. The interval of time that elapsed before the second increment of opioid medication was administered was greater for PPW than for NPW (mean time = 6.44 minutes versus 4.81 minutes), with a level of significance of $p < .10$ by the Mann-Whitney U test. When measured from the beginning of washing to the administration of the second increment of medication, the interval of time that elapsed again was greater for PPW than for NPW (7.11 minutes versus 2.55 minutes), statistically significant by the Mann-Whitney U test ($p < .05$).

Paper-and-Pencil Tests Designed to Clarify Interindividual Variations

Two pencil-and-paper tests, the Health Locus of Control (HLC) Scale (Wallston et al., 1976) and the short form of the Profile of Mood State (POMS) (Shacham, 1983) were administered for the purpose of identifying correlates of subjects' pain experiences and expressed preferences.

Health locus of control. Health locus of control scores, obtained by administration of the HLC, ranged from 13 to 30, with a possible maximum of 66, signifying very external locus of control, and a possible minimum of 11, signifying very internal locus of control (see Table 34). There was a weak correlation between HLC scores and Likert ratings of NPW preference ($r_s = 0.4750$, $p < .10$). There was a

Table 34

HLC Scores Versus Likerts for Preference of PPW and NPW

Subject	1	2	3	4	5	6	7	8	9	10
HLC Score	27	17	30	23	25	15	17	28	14	13
PPW	1.5	3	0.5	4	4	4	4	2	4	3
NPW	4	1	4	0	0	2	0	2	0	1

moderate negative correlation between HLC scores and Likert ratings of PPW preference (r_s = - .5824, $p < .05$).

Mood. Subjects' scores ranged from 19 to 74 on the short form of the Profile of Mood States (POMS), with a possible maximum of 120 and a possible minimum of -24 (see Table 35). When compared with Likert scores denoting preference of PPW and of NPW, only the

Table 35

POMS Scores and Subscale Scores

Subject	1	2	3	4	5	6	7	8	9	10
POMS Total Score	39	28	19	42	27	74	27	19	55	32
Subscales										
T-A	10	11	10	9	6	20	13	8	11	10
A-H	11	4	1	3	3	15	5	3	3	7
F-I	8	11	6	16	10	15	2	8	6	8
D-D	11	13	7	9	7	19	7	7	25	8
V-A	5	14	13	2	4	6	9	12	2	7
C-B	4	3	8	7	5	11	9	5	12	6

vigor-activity subscale of the POMS was significantly correlated (r_s = - .5922; $p < .05$) with preference for PPW (see Table 36). However, the total POMS score was weakly correlated with preference for PPW, as were the vigor-activity subscale with NPW preference and the confusion-bewilderment subscale with PPW preference ($p < .10$).

Table 36

Spearman Rank-Ordered Correlations of Short-form POMS Scores With PPW and NPW Likerts

POMS Subscale	PPW Preference	NPW Preference
Total	0.5091 ($p < .10$)	- 0.1906 (NS)
Tension-Anxiety	0.2471 (NS)	0.0321 (NS)
Anger-Hostility	0.1339 (NS)	0.1889 (NS)
Fatigue-Inertia	0.2569 (NS)	- 0.0449 (NS)
Depression-Dejection	0.2677 (NS)	- 0.0261 (NS)
Vigor-Activity	- 0.5922 ($p < .05$)	0.4940 ($p < .10$)
Confusion-Bewilderment	0.4946 ($p < .10$)	- 0.2723 (NS)

Qualitative Findings

The Nature of Procedural Burn Pain

Data obtained from interviews and from comments made by subjects during the dressing change were analyzed using the constant comparative method of analysis. Themes were spontaneously generated by subjects and then organized into a cohesive whole, using key constructs from the gate-and-coping framework presented in Chapter 2.

The Peripheral Contribution to Pain

Amount of pressure exerted with washing. During NPW dressing changes, nurses were observed to use both light touch and firm touch routinely, depending upon area of burn and upon each individual nurse's preference. In general, nurses were observed to use a lighter touch when washing fingers, toes, lips, noses and ears. They were observed to use a firmer touch washing limbs and torsos.

Most subjects preferred the use of light rather than firm touch for all body areas under conditions of both NPW and PPW. "They hurt me terrible because they wash hard," said Subject 4. Subjects remarked about areas that were more sensitive than others, noting increased sensitivity and pain in their fingers, with most subjects preferring a light, gentle touch for fingers and often hands. However, two subjects preferred that the nurses use a firm touch while washing all body areas and also preferred to wash themselves using a firm touch, "hard pressure," as Subject 3 called it. Subject 10 preferred that the nurses use a light touch but liked a medium pressure for PPW, explaining, "I can go more firm with myself."

Subject 6 preferred that the nurses use a light touch but preferred to use a firm touch himself for washing.

Speed of washing. Speed of washing also differed. Subjects 1, 4, 5, 6, 7 and 10 preferred slow washing, both for NPW and for PPW. Subject 9 preferred fast washing both for NPW and for PPW. Subject 7 explained, "I'd rather have a dressing change take longer and be less intense." Subject 2 preferred medium washing for both. Subject 3 said that he preferred his fingers washed quickly but his palms washed slowly; Subject 8 preferred his hands washed quickly but his arms washed slowly. Subject 8 stated that he preferred that both NPW and PPW be performed quickly. However, observation of him performing PPW revealed such slow washing that the burn staff nurses spontaneously remarked upon it.

Pattern of washing. Subject 6 preferred long washing strokes, and Subjects 6, 7 and 8 were adamant that washing with the direction, instead of against the direction, of the hairs on their arms was less painful. Subject 6 especially disliked "little circular strokes" and "the scrubbing motions the nurses used." Subject 8 preferred long strokes, noting that "it got it over with faster" and disliked "washing with short strokes." Subject 10 disliked "hard scrubbing," adding "when they'd wash one area over and over - I'd want to wring their neck."

The Norsen debridement tool. Subjects acknowledged that the Norsen debridement tool, used to scrape the burn wound free of eschar, was especially painful. However, some subjects were able to use the Norsen debrider themselves. Subject 8 reported, "it hurt

more but it was more effective." Subject 10 reported less pain with the Norsen debrider going with or against the direction of hair growth, and more pain going at right angles to the direction of hair growth, "crossways." He also said that when using the Norsen, dripping water on the wounds first made it less painful.

Use of water. Subjects 6, 8 and 10 remarked that a wetter washing sponge was less painful than a barely moist one. Subject 10 noted that warm water was less painful than cold, especially around the edges of the wound. He suggested putting the dripping sponge on the burn and letting it soak a moment before beginning washing.

Variation in style of washing. Variation in style of dressing change washing during NPW was not welcomed by Subject 1: "I felt irritated with changes in the way a new nurse would do the dressing using a new style," possibly reflecting his heightened apprehension in the face of the unpredictable.

Voluntary change in style of PPW, however, was a positive aspect for subjects. Subject 2 related that "I had more control over the intensity - I changed my technique according to how it felt." Subject 7 reported, "When I rubbed it fast, I stopped when I started to feel pain. I knew where the pain was." Subject 10 suggested changing the area of the burn that was being washed when the pain became too intense, going back to that area later in the dressing change.

The additive component of pain during washing. The additive nature of pain was an issue for some patients. Subject 2 noted that stretching to wash his arm burns during PPW created not only pain

in the area he was washing but also pain in his burned shoulder. Subject 6 noted the same problem for his upper arm burns. Relative to NPW, Subjects 4, 5, 6 and 10 stated that they preferred to be washed by only one nurse at a time, that being washed by two or three nurses at once was more painful: "I can only handle one thing at a time," said Subject 6. Subject 10 related that during NPW, "I felt like a huge scab in a dish and everyone was taking a shot." On the other hand, Subjects 1 and 2 stated that although being washed by two or more nurses at a time was more painful, it got the dressing change over with more quickly, and for that reason was preferable.

The Contribution of Central Control

Central control includes systemic medications and emotional "pre-set," relative to anxiety, apprehension and other emotional states.

Medications. An assortment of analgesics was used for premedication for the dressing change, and the intravenous (IV) medications fentanyl and morphine were given in titrated amounts through some of the dressing changes, as well. All subjects reported that some, but never all, of the pain was taken away by medications. "It took the edge off," said Subject 10. Subjects also reported that more of the pain was taken away with IV medications than with oral medications. Within one dressing change, Patient 2, after receiving additional IV fentanyl, reported no decrease in pain intensity. He explained, "it hurts the same, but it doesn't bother me as much," possibly referring to a decrease in affective distress without a decrease in the sensory aspect of his pain.

Subjects 4 and 5 both believed that their level of analgesia was insufficient during at least some of their dressing changes. Subject 5's IV, believed to be patent, was actually not in the vein for her initial dressing change. She noted a marked difference in her pain between that first dressing change and subsequent days of NPW. Subject 4 was medicated sparsely during the first week of her hospitalization because of her respiratory sensitivity to opioids.

Subject 10 identified that, for him, administration of his oral pain medication half an hour before the IV pain medications of the dressing change was helpful in minimizing pain, although longer than half an hour was less effective. He also preferred having a few minutes elapse between administration of IV medications and the beginning of the dressing change. Subject 7 commented that, to him, "it seemed like they didn't wait long enough for the medication to take effect," before beginning the dressing change.

Previous anxiety, apprehension, vigilance and experiences. No subject interview comments directly supported the contribution of preexistent anxiety, tension, depression or past experience upon pain. However, Subject 4 expressed her dread of the dressing change whenever she was told it was now time to go to the tubroom for the dressing change. She appeared terrified just before each procedure. Subjects 1, 2, 5 and 6 appeared relaxed and affable and were able to answer questions coherently and to concentrate before dressing changes. Subjects 3, 7, 8, 9 and 10 appeared serious and somewhat preoccupied but did not display Subject 4's level of increased apprehension. Subjects 9 and 10 both verbalized disliking the

dressing change but did not seem anxious or agitated related to its imminence.

The Gate Control Mechanism

The gate control mechanism is the hypothesized process by which an impulse is capable or incapable of producing the sensation of pain. The extreme of a pain score of zero represents no sensation of pain. The extreme of a pain score of 10 represents the quintessence of pain, implying that modulation of some kind is likely to occur.

Zero pain. Subjects 1, 4, 5, 7, 8 and 9 reported zero scores of pain intensity before dressing change washing began, when they had already been premedicated. Subjects 4, 7, 8 and 10 reported zero pain during some, not all, of PPW. Subject 7 reported no pain at all during his second PPW face-washing, after premedication with oral analgesics, when his burns were almost healed.

Fluctuation of pain intensity. The intensity of pain, reflected in numerical scores, and described as fluctuating by one patient, was noted to vary throughout both NPW and PPW dressing changes. Pain intensity scores differed intraindividually, apparently in response to area of washing, style of washing, amount of premedication and stage of healing of burn wounds.

The pain intensity score of 10. When a pain intensity score of 10 (worst pain imaginable) was reached, a result invariably occurred. During PPW when Subject 6 reported a 10, he then self-corrected his technique, which resulted in a pain intensity score of 7 thirty seconds later. Subject 1 explained that he took his time during PPW

in order to avoid causing himself intense pain: "It's like committing a crime against yourself."

During NPW, the intensity score of 10 was used 54 times by subjects. When the score of 10 was reached, subjects were observed initially to involuntarily start, jerk or stiffen. Subject 1 explained, "When you're hollering out numbers during the dressing change, a 10 is just beyond bearable." Accompanying 10s, a certain amount of explosive verbal punctuation occurred, ranging from a prayerful, "Oh my God!" or Oh God!" or "Help me, God" to swearing, "Damn!" and scatological expletives, "Shit!" Other comments included, "I'd rather be dead," "I want to die," "Dying isn't this bad," "I have to get out of here," "I'm going to pass out. I can't stand it," "There's got to be a better way," and "It gets worse every day." Subjects also requested breaks, with "Stop, would you, please?" One subject requested a means of self-distraction, "Give me something to squeeze in my other hand." Several subjects, when in extreme pain, did not immediately respond to a request for a numerical pain score and had to be asked again. Subject 4 said, "When I'm screaming, honey, it's a 10." Subjects 1, 4, 5, 8 and 9 were observed to visibly shed tears during NPW when scores of 10 were reached.

During PPW, subjects did not use additional words to convey extreme pain. Their comments were often observations on washing or wounds, or questions about whether they had washed a burn to the nurse's satisfaction.

Descending Inhibitory Control

Subject comments regarding descending inhibitory control encompass several nonphysical variables that impact pain intensity.

The physical milieu. Subjects commented on the effect upon pain of their surroundings, both inanimate and animate. "A quiet room" and "gentle conversation," made pain less intense for Subject 1. "Talking to me" was mentioned by Subject 3 as contributing to decreased pain, and "not talking to me" exacerbated pain. "Distraction and diversion" by nurses were mentioned by Subject 10 as useful in controlling pain.

Predictability. Subject 3 found that the nurses "explaining what was going to happen before it happened" and "knowing what to expect" made the pain less intense for him. He related feeling nervous for dressing changes "because I hate pain." Subject 7 said that the dressing change was "easier when I did it than when the nurses, 'cause I knew where the next pain would be coming. There's less fear." Subject 7 added that his experience of NPW was negative, relating, "I didn't know what they were going to do next - they'd just each grab an arm." Subject 3 concurred that not knowing what to expect made his pain worse.

The personal touch. "Being treated like a person" caused Subject 3 to feel less pain, and "not being treated like a person" made his pain worse. Subject 4 related that "when the nurses would giggle and laugh, it seemed like they were laughing at me. Talk and laughter made it seem like the nurses enjoy what they're doing - it makes me sick to think about it." Subject 6 noted that the dressing

change seemed to go faster when there was some verbal exchange and "kidding;" he was observed to relax in response to nurses with a calm and informal verbal style.

All subjects were observed to relax when various members of the burn team (nurses, physicians, therapists) remarked favorably about the progress of wound healing. Subjects seemed to prefer being told that they were healing well rather than being referred to in the third person; the style of one member of the team was to inspect the wounds and state to no one in particular, "He's healing well." Subject 3 might have called this "not being treated like a person."

Control and powerlessness. Regarding the necessity of being a burn patient, Subject 3 stated, "I have no control over this."

Subjects were asked whether they felt as if they were in control during NPW and during PPW. Subjects universally reported feeling in control during PPW, but Subjects 2, 4, 7, 8, 9 and 10 reported that they did not feel in control during NPW, either some of the time or all of the time. Subject 10 said that it depended upon which nurse was performing NPW. Subjects 1, 4, 7 and 10 stated that nurses did not always stop washing during NPW when asked to, or if they did stop on request did not stop long enough. Subject 10 reported, "Some nurses would say, 'It's got to be done' and then they'd just keep doing it," not pausing on request. "They're trying to do their job - but some nurses are kind of callous. Some ask questions, 'How's this?' and give you the power to stop when it's too painful. Some of the nurses, you just want to choke 'em." This

inability on the subjects' part to establish an adequate pause during NPW may have generated feelings of powerlessness.

The pace of the dressing change. Subject 4 said, "Psychologically, a breather helped," rather than just to continue with NPW from start to finish. "I'd rather have a dressing change take longer and be less intense," said Subject 7. "They'd stop but not for long enough - they seemed in a hurry, especially at first." Subjects 4, 5, 7 and 10 stressed that the nurses wanted to wash faster than the subjects would have preferred.

Time of the day. Subject 10 noted that for him the evening dressing change was less intensely painful, except when it was done late in the shift, in the small hours of the night - "then there was intense pain."

Fear. During NPW, subjects related various fears. Subject 1 felt fearful that the nurses "might accidentally drop my legs or accidentally hit me on the legs." Subject 4 feared the nurses "rubbing" the burns, meaning vigorous washing. Subjects 5, 7 and 10 feared pain. Subject 6 feared "not being able to control how much I hurt." Subject 9 was "afraid of the nurses thinking I was some kind of a punk - a troublemaker."

During PPW Subjects 1 and 10 were afraid they were going to hurt themselves but Subject 10 related "I was less nervous about hurting myself than about the nurses hurting me." Subject 7 also remarked that with PPW he was less fearful than with NPW. Subject 7 did relate, however, that when he looked at his burns during PPW, he was afraid of "what other people would think of the

scars." Relative to self-washing, Subject 8 related feeling "afraid of doing it wrong."

Coaching. Subject 8 reported, "It helps to have the nurses encouraging and advising me." Subject 10 reported feeling of gratification, thinking, "Hey, I did it right," in response to nurses saying he was doing a good job of PPW. "It's important for the nurses to acknowledge that you're doing a good job," he explained.

Appraisals

Appraisals include assessments of the meaning of the experience, the classification of an experience as positive or negative, and the formulating of plans for ways to modify the experience or to modify the individual's thoughts and feelings about that experience.

The primary appraisal. Lazarus (1980) described the primary appraisal as classifying a stressor as irrelevant, benign-positive or stressful. Wound cleansing appeared and was described as stressful, as opposed to irrelevant or benign-positive. Within the stressful category, Lazarus described a further classification into harm-loss, threat or challenge. The appraisal process was evident in subjects' words and actions.

NPW as challenge. Subject 5's observation about NPW, "It had to be done, it was for the best, and I had to endure it" is an appraisal of a painful experience as almost a challenge, rather than harm-loss or threat.

NPW represented a unique challenge for Subject 6, after his first day of PPW, upon reversal back to NPW. He no longer had physical control of the dressing change, but he established verbal

control and took advantage of his considerable verbal ability to talk the nurses through performing the dressing change washing in the way he found least stressful.

NPW as threat. Referring to the NPW dressing change during which her IV had been infiltrated, Subject 5 said, "I wouldn't want to go through that again," and there was the implication that there was a possibility she might, if another infiltrated IV weren't detected. Subject 6 reacted to nurses washing his burns as threat when he first allowed the nurse to wash his hard-to-reach areas during PPW but then took back the washing sponge to finish when it appeared that the pain would be unacceptably intense. Several subjects noted that, in general, NPW was more painful than PPW.

NPW as harm-loss. Subject 4 referred to NPW as "the worst experience of my entire life." For her, every instance of NPW was dreaded.

PPW as challenge. PPW held elements of challenge for all subjects. Subjects were seen to become engrossed in performing PPW, to a greater or lesser degree. While they were washing, subjects became quiet except to ask for directions. Subject 2's statement that when the patient elects PPW "he's there to do a job, not slack off," echoes challenge. Subject 10 related, "A lot of it's just gritting [your teeth] and bearing it. After 4 or 5 times doing a dressing change, you know all that stuff has to come off, so you push yourself to do it." Other examples of PPW as challenge were demonstrated by Subjects 2, 6 and 9 when they debrided eschar that

the nurses had been unable to remove, and by Subjects 9 and 10 when they self-debrided so forcibly that they bled.

PPW as threat. PPW appeared to be threatening at first to some subjects. Subject 1 was afraid of hurting himself. Subject 7 found PPW distasteful initially because of having to look at his burn scars. Subject 2 preferred NPW because of his conviction that "the nurses did a better job" than he did in washing the burns; had he been required to perform all washings, PPW might have come to represent threat.

The secondary appraisal. The secondary appraisal, and subsequent reappraisals, select a strategy, either emotion-focused or problem-focused, designed to decrease stress.

Problem-focused strategies. Problem-focused strategies may be action, inhibition of action or information-seeking.

In NPW, the problem-focused strategy of action was physically limited to the behavior of pulling away from the nurse. This behavior was countered by the comment, "Try to hold still," by the nurse performing the washing or by the physical intervention of the nurse holding the subject steady for washing. There was a second problem-focused strategy of action that was represented by some subjects' talking the nurse through all or part of the NPW, as they gained experience in the process, saying, "Be careful of the fingers," or, "Wash with the direction of the hair growth."

The problem-focused strategy of inhibition of action was employed by all subjects as they suppressed their inclination to pull

away and submitted to NPW. As Subject 5 said, "it had to be endured."

The problem-focused strategy of information-seeking was employed by subjects to try to enhance the predictability of the NPW. Subjects asked when the dressing change would occur, which areas would be washed first, which areas needed washing or debridement, how much medication they were being given and, during NPW, how much longer the dressing change washing would take.

In PPW, the problem-focused strategy of action was represented by subjects actually washing their wounds and varying their technique according to effectiveness within an acceptable pain range. Several subjects were observed to wash and debride as vigorously as, or more vigorously than, the nurses. The first attempt at PPW was often tentative and unsure, having to be supported by nurses' verbal encouragement. Subsequent attempts were more confidently undertaken. Subject 5 said, "I felt uncertainty at the beginning, but OK later." It appears that feelings of competency play a part in subjects' desire to perform PPW. In support of PPW, subjects reported, "Now I know how to wash my burns," or "I got to see what I could do here and couldn't do here [referring to areas of his body]," "I have the feeling I can do at least this much" and "Actually it makes you feel better." Feelings of competency seemed to emerge in response to practice and to praise by nurses. Subject 2 referred to performing PPW as doing a job, implying a task that required competent performance.

In PPW, the problem-focused strategy of inhibition of action was represented in Subject 1 by attempting to look as if he was washing but taking care not to wash as vigorously as the nurses had washed.

In PPW, the problem-focused strategy of information-seeking was enacted by subjects as they asked for direction regarding which areas needed more washing and which were appropriately washed, and as they asked for confirmation that they were performing PPW adequately.

Emotion-focused strategies. Emotion-focused strategies are thoughts and actions designed to reduce stress. Lazarus (1980) defines them as intrapsychic.

In NPW, the emotion-focused strategy of rationalization was used by many subjects when they justified the pain that they had endured as necessary for recovery. "It was for the best," as Subject 5 said. "I felt like they was trying to help me," said Subject 8.

Subjects 1, 3, 4, 7 and 8 stated that the best aspect of NPW was that the nurses knew what they were doing. This assessment of nurses' competency in washing wounds justified the pain. "The nurses knew what they were doing," said Subject 1. Nurses' vigor in debriding more than individual subjects could debride, despite the intense pain subjects reported, and mentioned by Subjects 5, 7 and 8, was also equated with competency.

Subject 8 declined to self-wash his chest after the first day, saying that he knew he couldn't cause himself as much pain as the

nurses did. He seemed to be less reluctant to endure intense pain if he did not have to inflict it upon himself.

Resignation to the inevitable was helpful to Subject 10. Relative to dressing changes in general, he explained, "It takes awhile before you realize that this has to be done, that there's no getting around it - it's just the way it is."

Qualitative Findings As They Relate to the Gate-and-Coping Framework

Although research subjects did not explicate the specific points in the gate-and-coping framework which their comments illustrated, it is possible to hypothesize the theoretical explanations for subjects' statements and behaviors related to dressing change pain.

The Peripheral Contribution: Small-Fiber Nociceptive Afferents.

Stimulation of small-fiber nociceptive afferents initiates the sensation of pain. Both the number of nociceptive afferents activated and the frequency of their discharge contribute to the intensity of the resultant pain.

Light versus firm touch. Subjects who described light touch as their preference, stating that it was less painful than a firmer touch, were in effect voicing a preference for minimization of the firing of their small-fiber nociceptive afferents. A lighter touch causes firing of fewer nociceptors, resulting in a subjective sensation of decreased pain intensity.

When nurses were observed to use a lighter touch in washing fingers, toes, lips, noses and ears, areas rich in nociceptors, they seemed to be drawing upon past experience, when previous patients

protested anything except a light touch for washing these sensitive body areas. Subjects were most adamant about use of a light touch for fingers.

The frequency of nociceptive firing. When subjects objected to fast washing, preferring slow washing, they were electing a technique that hypothetically produced a lowered frequency of nociceptive firing, decreasing perceived pain. Subjects' objections to small circular strokes while washing, or to washing an area over and over again, identified the increased pain caused by these techniques, which theoretically produce a greater frequency of nociceptive firing. The subject who mentioned the technique of stopping while washing a certain area when the pain became intense and going to another area awhile before finishing the first may have been responding to a summation phenomenon whereby the pain produced by repeated stimulation of a group of nociceptors had reached an exaggerated level, and only a period of no stimulation would allow the phenomenon to abate.

The pattern of nociceptive firing. Subjects' comments related to being able to adjust their own technique may have reflected the pattern of nociceptive firing produced by various techniques. Different techniques of washing stimulate different patterns of nociceptors, producing different perceptions of pain. It is reasonable that subjects would select the techniques that caused them the least pain for a given level of washing efficacy.

Technical suggestions by subjects, such as washing with the direction of hair growth, using the Norsen debrider with or against

the direction of hair growth but not at right angles, and making sure the washing cloth and wound were wet enough, may reflect subjects' sensitivity to different patterns of nociceptor firing.

The additive nature of pain, noted when PPW of one area caused pain as other burned areas were stretched or compressed, or when NPW performed by two, three or four nurses exceeded the pain of NPW performed by a sole nurse, may have been due to the pattern of nociceptive impulses produced, if the nociceptors stimulated were adjacent or relatively close to one another.

The Peripheral Contribution: Large-fiber Inhibitory Afferents.

Firm touch. Stimulation of large-fiber inhibitory afferents modulates the pain impulse. Subjects who preferred a firmer touch may have done so because the pressure stimulated large-fiber afferents that modulated the pain impulse. Although two subjects preferred firm touch for both NPW and PPW, one subject preferred a firmer touch for PPW but a lighter touch for NPW. Apparently, the nurses' technique did not create the degree of pressure that effectively recruited his large-fiber afferents without stimulating an undue number of small-fiber nociceptors.

The Contribution of Central Control

According to Melzack and Wall (1965), central, later named cognitive, control is capable of transmitting information to the brain, via the dorsal column medial lemniscus system, or the dorsolateral path. In addition to attention, tension, past experience, vigilance, anxiety, depression and excitement, systemic medications are capable of modifying the brain's synthesis of a pain experience.

Medications administered to burn patients for dressing changes, so that procedural pain will be less intense, alter the central control trigger. Theoretically, previous levels of attention, tension, vigilance, past experience, anxiety, excitement and depression help to establish the initial level of the central control trigger. However, subsequent events during the dressing change that alter attention, tension, and the like, probably act at the level of descending inhibitory control, facilitating release of endorphins that modulate pain in an ongoing manner.

The Gate Control Mechanism

The gate control mechanism, or system, is Melzack and Wall's (1965) hypothetical term that encompasses modulation of peripheral nerve impulses by gating at the dorsal horn and explains both variation of pain intensity and the phenomenon whereby nociceptive impulses do not produce the sensation of pain when it is expected to occur.

Zero pain. In burn injury, patients are seldom pain-free. The existence of pain-free intervals for a burn patient is an example of the closing of the gate control system: there is no sensation of pain, despite the certain presence of nociceptive impulses. After premedication, and preceding the dressing change activities, the existence of pain-free intervals is logical.

Fluctuation of pain during the dressing change. The fluctuation of pain during the dressing change seems to be due to differential stimulation of peripheral nociceptors, intraprocedural administration of medications and endorphin release by the descending inhibitory

control system. Pain with NPW should indeed fluctuate as nurses pause in their washing efforts to reach for a different debridement instrument or to turn their attention to a different burned area. Pain with PPW should fluctuate as patients concentrate on different areas or pause for a moment of rest.

The pain intensity score of 10. The pain intensity score of 10 theoretically represents maximal pain (worst pain imaginable), before modulation. Since the descending inhibitory control system appears to be activated in response to the body's pain, the pain score of 10 may be assumed to be a prelude to the release of endorphin. Additionally, since the pain score of 10 is associated with such intense pain, there is the implication that pain at this maximal level triggers some kind of reflex physical response. The reflex response that occurred during PPW was a self-correction of technique; the reflex response that occurred during NPW was a start, a jerk, an exclamation, or a plea for respite. It is hypothesized that under the condition of PPW, the stimulus of intense pain causes a reflex response inhibiting whatever activity produced that pain; this explanation clarifies why 10s occurred so infrequently during PPW.

Descending Inhibitory Control

Descending inhibitory control provides additional modulation of the pain impulse chiefly by the body's endorphin release, occurring in response to pain. Descending inhibitory control seems enhanced and supported when burn patients are relaxed, at ease and in predictable circumstances, and it seems inhibited or diminished when burn patients are anxious, apprehensive, vigilant or fearful.

Accordingly, alteration in the physical milieu (both animate and inanimate), predictability, "bedside manner," control, the pace of the dressing change, the time of day, fear, and the availability of coaching for the patient during the dressing change all appear to positively or negatively affect pain intensity through the descending inhibitory control system.

Appraisals

For the burn patient, appraisals can be primary appraisals, secondary appraisals or reappraisals. The primary appraisal for the hospitalized burn patient is invariably that the situation is stressful, rather than irrelevant or benign-positive. Stress is then classified as challenge, harm-loss or threat. The stressful situations of NPW and PPW during the dressing change are classified into these three categories of challenge, harm-loss or threat, but they are capable of being reclassified, according to changes in the circumstances of the dressing change. Challenge, threat and harm-loss, although strictly situational classifications, also emanate from the life coping patterns of the burn subjects. Each subject had his or her own pre-injury threshold of threat and harm-loss, and some subjects classified practically every stressful situation within the context of the dressing change as threat, or harm-loss, or challenge.

The secondary appraisal and subsequent reappraisals are identical in function, in that they select a strategy designed to decrease stress, which during the dressing change seems principally due to the stressor of physical pain. From the point at which the dressing change became an inevitability, until its completion, burn

subjects were seen to select problem-focused and emotion-focused strategies designed to reduce the stressor of pain.

Problem-focused strategies are action, inhibition of action or information-seeking, all of which are designed to change the self or the stressor. Within the context of the burn dressing change, problem-focused strategies of action, inhibition of action and information-seeking were all seen. Strategies of action impact the peripheral input of the gate-and-coping framework. Strategies of inhibition of action produce a status quo in peripheral input but appear to impact the descending inhibitory control system. Strategies of information-seeking also appear to impact the descending inhibitory control system. It is likely that the burn patient who sees PPW as a challenge rather than as harm-loss or threat, and who makes the decision to enact PPW, also impacts the descending inhibitory control system.

In this context, enacting PPW can also be seen as partially emotion-focused. An emotion-focused strategy is intra-psychic, and it is best described as a new way of thinking about the situation. An emotion-focused strategy impacts the descending inhibitory control system.

Key Concepts Related to Washing of Burn Wounds

Exhaustion. One key word subjects generated was that of mental and physical exhaustion. Subject 2 reported that when he didn't feel well, after a sleepless night, he preferred the nurses to wash his burns, because "it didn't tax me - I could concentrate on controlling the pain, the mental aspect, instead of on the physical

technique." He also reported that the effort of mentally coping with the pain in addition to washing his own burns was tiring. A sense of saturation with the pain experience pervaded this exhaustion. Subject 5 said, "I've gone through so much pain now that I feel as though I can't face any more pain in my life - even something little like waxing my upper lip or plucking my eyebrows." She also reported that when her face burns were almost healed and only minimally painful, she preferred to have the nurses wash her face: "It's like going to have your hair done - you can just lie back and let someone do it for you." It seems that having one's almost-healed burns washed may possess an element of comforting or being cared for.

Self-respect. Subject 10 related that for NPW, "I had a lot of apprehension and was in a vulnerable position. I was intimidated by that. I felt self-conscious and belittled when I was in the tub - it was demeaning." For PPW, however, Subject 10 related, "Washing your own burns makes you feel better about yourself. Washing well is like saving face - I had no self-worth left, and that gave me back a little. 'See? I can do it as well as you.' Washing your own burns makes you say, 'I'm in control of this.'"

Expertise. The concept of expertise was described by many subjects, if they had more than one opportunity to self-wash. Admitted Subject 10, "I know I can do a better job picking away [debriding dead tissue] without causing bleeding. When you hit blood, it hurts." He added, "You improve as you go - you learn ways of getting [dead tissue] off with the least amount of effort and pain."

Preference Of NPW or PPW and Advice to a Friend

The reasons for subjects' preference of NPW or PPW were elicited. Opinions regarding which type of washing subjects would advise a friend to use, if the friend were an inpatient in a burn unit, were also elicited, with rationale for that advice.

Preference of NPW or PPW. The reasons for preference of NPW differed. Subject 1 preferred NPW because leaning over to wash his ankles and lower calves compressed his legs, causing a tourniquet-like effect and resulting in painful throbbing. He stated that the actual washing of his burns was less painful when he did it himself but that "the blood rushing to my legs" made the experience more painful. Subject 3 preferred NPW because he believed that he performed PPW inadequately and that the nurses "did a better job." Subject 8 preferred NPW for his more painful areas, stating that he couldn't wash as hard as he "knew it needed to be done." Subject 8's understanding of the process of self-washing was, "I tried to make it hurt the same because I knew I was doing it right," which represents his misunderstanding that washing adequacy was absolutely correlated with pain.

Reasons for preferring PPW varied. All subjects acknowledged PPW as causing less pain. Subject 2 stated that he could change his technique to vary the intensity of his pain. Subject 4 stated that she liked to wash her burns more slowly and gently than the nurses did. Subject 5 found that she could perform washing and debridement and cause herself less pain than when the nurses washed. She said that if she had realized at the beginning of her hospitalization how

much washing and debridement she could have been doing, she would have insisted on doing as much as possible by herself and just letting the nurses finish the parts that she couldn't do. Subject 6 preferred PPW because of the element of control, both physical and mental control; he stated, "We can generate more tolerance to pain when we're doing it ourselves; it makes a person feel like they have some control." Subject 7 preferred PPW because "there's less pain, less fear, and you can take your time." Although not critical of nursing staff, Subject 7 stated, "A burn victim - there's a lot of hurt there - nurses and doctors just can't know the pain unless they're burned. Anybody in the world can feel sorry for you but they can't know what you feel." Subject 9 preferred PPW "because I have some control over it." Subject 10 also preferred PPW because of the aspect of control.

Advice to a friend. All except one subject held the opinion that if a friend were burned, at least trying PPW would be desirable. Subject 3 alone said unequivocally that he'd advise a friend to use NPW. Subjects 2, 4, 8 and 9 said that they would advise a friend to try PPW and to decide what was preferred. Subjects 5, 6, 7 and 10 stated that they'd advise a friend to use PPW and to do as much of the washing as possible. Subject 1 said that he'd advise NPW for leg burns and PPW for burns that were "reachable." Subject 2 said he'd tell a friend, "Go ahead and try but know that you're there to do a job, not slack off."

Findings That Impact the Study's Internal Validity

Adequacy of washing. Qualitatively, several subjects reported that the nurses were more thorough and more vigorous than the subjects themselves could have been. Observation of subjects supported this view for Subjects 1, 3, 4 and 8. These four subjects appeared to wash gently and not to cause themselves intense pain; nonetheless, the final visual result of their efforts was a clean and well-debrided wound area. Observation of subjects refuted the notion that nurses were more thorough and vigorous, for Subjects 2, 5, 6, 7, 9 and 10. Subjects 2, 5, 7 and 10 appeared to wash and debride with as much vigor as did the nurses, also producing a visually acceptable result on evaluation. Subjects 6 and 9 self-debrided and washed with more thoroughness than did the nurses on the days preceding and following PPW; visual inspection of wounds revealed a complete debridement of the somewhat adherent eschar of the dorsum of their hands, which the nurses had been unable to accomplish in previous dressing changes.

Medication administration. Qualitatively, it was noted that subjects who were performing PPW would become engrossed in their activities of washing and debridement. During PPW, therefore, administration of additional increments of medication usually followed the nurse's unilateral mention of the availability of additional medication. During NPW, administration of additional increments of medication followed the patient's request for additional medication, the patient's verbal reporting of 9s or 10s, or the patient's screams, shouts or expletives.

Summary Related to The Research Questions and Hypotheses

Hypotheses tested. Three research hypotheses were tested. The null hypothesis that there would be no significant difference in pain intensity scores under conditions of NPW versus PPW was rejected. Subjects manifested a significant difference in pain intensity during PPW versus NPW washing, as measured by moment-to-moment intraprocedural concurrently-obtained perceived pain scores, on a continuous 0-to-10 scale, and as analyzed by intrasubject repeated-measures ANOVAs with secondary Scheffé analysis (p-values ranging from $< .001$ through $< .05$).

There was failure to reject the null hypothesis that if subjects displayed a significant difference in pain intensity scores, with PPW less painful than NPW, they would not necesssarily prefer PPW. Significantly decreased intraprocedural pain intensity scores did not guarantee subject preference of PPW. All subjects reported a significant decrease in pain intensity scores with PPW, but only seven subjects expressed an unqualified preference for PPW.

There was failure to reject the null hypothesis that there was no difference in washing adequacy when burn patients and nurses were compared. Washing efficacy was evaluated by blind raters, yielding Likert ratings, and no significant difference was detected by the Mann-Whitney U test between Likert ratings of PPW and NPW thoroughness ($p < .05$).

Pain quality. Subjects reported a difference between pain quality during PPW versus NPW washing, as measured by the McGill Pain Questionnaire. Although both NPW pain and PPW pain were

described as exhausting, tender, stinging, sharp, burning and tight, NPW seemed to be more piercing, shooting, wrenching, searing, hurting, sickening, fearful and tearing, whereas PPW was more jumping, pricking, aching and radiating in quality.

Subject preference. Subject preference was divided, with seven subjects preferring PPW, two preferring NPW and one preferring PPW for less painful areas and NPW for more painful areas. Subject preference seemed to be related most strongly to number of times subjects self-washed, to the evaluative subscale of the MPQ, to the HLC, and to the vigor-activity subscale of the short-form POMS.

Opinion of advice to a friend. Advice subjects would offer to a hypothetical friend who was a burn patient was also mixed. One subject would recommend NPW to a friend; another would recommend NPW for leg wounds and PPW for easier-to-reach areas. All other subjects would advise a friend either to choose PPW or to try it and decide whether it was personally preferred.

The nature of procedural burn pain. The nature of procedural burn pain was defined by subjects as different for PPW and for NPW. Both PPW and NPW pain were dependent upon type of touch, speed of washing, variation in style of washing and amount and type of premedication administered. However, PPW and NPW pain differed in that PPW apparently increased predictability in some subjects and allowed subjects to vary their physical style and self-correct in response to pain. Variables reported by subjects to affect NPW pain were the physical milieu, being told what was going to happen and

being addressed as a person. Subjects who preferred PPW reported that its efficacy in decreasing pain was due to the ability to self-correct, to decreasing the factor of fear, to a preference for being in control, or to the ability to tolerate self-inflicted pain more readily than other-inflicted pain.

Pain medication comparison. Medication administration during dressing changes, for four hours after dressing changes, and from the data-collection dressing change to the next dressing change was evaluated. No significant difference between amount of medication administration, for PPW versus NPW, existed ($p < .05$).

CHAPTER 5

CASE REPORTS BY GROUP AND BY SUBJECT

When considering all of the above data in isolation, pain scores, quality of pain, individual preference and hypothetical advice for a burned friend appear to be occasionally at odds (see Table 37).

Table 37

Overview of Individual Subjects' Responses

Subject	Pain Intensity Significance	McGill PRI for NPW	McGill PRI for PPW	Preference	Advice To Friend
1	.05	18	26	NPW	Mixed
2	.001	42	25	PPW	Try PPW
3	.005	36	41	NPW	Do NPW
4	.001	58	31	PPW	Try PPW
5	.001	28	7	PPW	Do PPW
6	.001	40	22	PPW	Do PPW
7	.005	27	4	PPW	Do PPW
8	.001	16	16	None	Try PPW
9	.05	52	39	PPW	Try PPW
10	.01	47	34	PPW	Do PPW

However, inspection of the array of individual subjects' responses reveals the pain of washing wounds, and also variables other than pain, as reasons for preferring NPW or PPW.

It is tempting to regard the ten subjects in this study as an overall "average" burn victim and to conceptualize the group's mean

or mode demographic and social variables as part and parcel of this fictional representative character. His reactions to NPW and PPW, his reactions to burn hospitalization and his preferences constitute a compelling, but deceptive, portrait. An unremarkable character, free of nuance, results.

Norm. The representative subject thus produced is a 38-year-old man by the name of Norm. Norm spent 13 days in the hospital as the result of a flame burn. He was burned over 19% of his body, with a 6% full-thickness burn that required one surgery for skin-grafting. Norm is married and has two children. He is employed and has a negative history for both drug and alcohol abuse. He himself comes from a family of five children and he is third in birth order.

Norm's pain scores during NPW ranged from 4.5 to 9.0 and during PPW ranged from 2.4 to 6.5 His pain intensity scores showed a significant difference between NPW and PPW days ($p < .001$).

Norm described his NPW pain as stinging, exhausting, piercing, shooting, sharp, wrenching, searing, hurting, sickening, fearful, tearing, throbbing and tender. He described his PPW pain as exhausting, jumping, tender, pricking, sharp, burning, stinging, aching, radiating, tight, pulsing, pinching and pulling. His MPQ PRI for NPW was 36 and for PPW was 24.

Norm prefers PPW over NPW, with Likerts of 4 for PPW and 0 for NPW. He would advise a friend to try PPW, were the friend a burn patient. He says he prefers PPW because he has more control.

Pain, however, is a private and individualized perception of sensory-based misery. Response to any intervention that purports to

change the perception of pain must vary interindividually. Each individual's case report, with pseudonyms inserted for individuality instead of subject numbers, provides a representation of a possible outcome of the intervention of PPW and variables that may impact patient preference.

Adam. Adam is a 25-year-old man, a data-entry operator, unemployed for one week. An only child, he was raised by his grandparents who are no longer living. He does not drink or use drugs. He was filling a lawn mower with gasoline when it burst into flames, catching his trousers on fire. His burns were 16% TBSA, partial-thickness. He was hospitalized seven days.

Adam's pain intensity scores were significantly lower for PPW than for NPW ($p < .05$), but his MPQ PRI was higher for PPW than for NPW. His personal preference was for NPW, with Likert scores of 4 for NPW and 1.5 for PPW. His advice for a friend was to choose NPW for leg burns but to choose PPW for burns that were "reachable." The reason he gave for preferring NPW was that leaning down to wash his own burns caused his blood to "rush to his legs," producing throbbing. He performed only one dressing change while hospitalized and confessed to washing as lightly as he could while still making it appear convincing for the nurses. Nonetheless, the result of his self-washing appeared adequate.

Although the tourniqueting effect that Adam experienced had nothing to do with his burn injury, it served as the reason his pain with PPW was exacerbated. His advice to a friend to wash his own wounds if they were within reach reinforces his statement that the

washing aspect of PPW was less intensely painful for him than the washing aspect of NPW. However, for Adam, throbbing represented an important element of his pain and could be avoided by having the nurses perform the dressing change.

Bob. Bob is a 35-year-old man who works with specialty lining and coating systems for flooring, vaults and other surfaces. He was injured on the job when an oxygen explosion in an oxidizer cylinder occurred. The third of five children in his family of origin, he is now married and has four children. He drinks lightly recreationally but does not use drugs. His burns were 16.5% TBSA, deep partial-thickness. Although the best treatment for the burns would have been elective grafting for his hands, his respiratory status, with significant inhalation injury, almost guaranteed a lengthy and troublesome period on the ventilator were he to be intubated. He was hospitalized eight days. He performed his own washing at least twice while hospitalized, debriding his hands and arms with great concentration, deliberateness and thoroughness, using a Norsen debrider or a pair of scissors to scrape off the eschar. Staff nurses commented spontaneously upon his pain tolerance and efficacy.

Bob's pain scores were significantly lower for PPW than for NPW ($p < .001$), and his MPQ PRI was higher for NPW than for PPW. His personal preference, however, was for PPW only for the first dressing change of the day, with Likert scores of 3 for PPW and 1 for NPW; he preferred NPW, however, if he required a second dressing change in the evening, partly because of his increased work of breathing and consequent exhaustion near the end of the day. His

advice for a friend was to choose PPW but to understand that one had to work, not "slack off." The reason he gave for preferring PPW was that he could adjust his technique, thereby diminishing pain; the reason he preferred NPW for the second dressing change of the day, and for the first dressing change on the second morning of NPW after a sleepless and short-of-breath night, was exhaustion.

Although the exhaustion Bob experienced may have been wholly due to his respiratory injury, it is not inconceivable that even without inhalation injury Bob would have been so tired at the end of the day that PPW would have been beyond his personal strength.

Chris. Chris is a 34-year-old man with a seizure disorder that was not well-controlled by medications, resulting in Chris being on medical disability for the past 13 years. His seizures developed after an industrial on-the-job head injury. Chris was burned when he fell against a wood stove during a seizure; he had been hospitalized a month earlier for skin grafting resulting from an identical accident. The second burn injury resulted in a 6% burn injury, with 1% full-thickness injury, which required one surgery for skin grafting; he was hospitalized nine days. Chris is the eldest of seven children. He now lives with his girlfriend and a 16-year-old son from his previous marriage. Chris has a past history of cocaine and crack use but does not use drugs at this time. He drinks alcohol rarely. He seemed subdued and hopeless during his hospitalization, verbalizing that he felt he had no control over the hospitalizations or over his epilepsy. Chris reported that he typically feels foggy and not mentally at his best for up to two weeks following each seizure.

Chris's pain intensity scores were significantly lower for PPW than for NPW ($p < .005$). His MPQ PRI was higher, however, for PPW than for NPW. He expressed a preference for NPW, with Likert scores of 4 for NPW and 0.5 for PPW. His advice for a friend was to choose NPW. The reason he gave for preferring NPW was that the nurses did a better job, washing and debriding more vigorously than he believed he could. Whether Chris's feelings of mental fogginess caused his lack of inclination to self-wash, whether feeling discouraged over his lamentable health situation left him blunted and unable to become enthused over PPW, or whether he preferred to let the nurses take responsibility for the wounds because of the belief that they did a better job, his own preference was for NPW.

Darlene. Darlene is a 65-year-old woman who was burned over 37.5% of her body when her nightgown caught fire while she was cooking; 30.5% of her burn was full-thickness. She was hospitalized 49 days and was skin-grafted twice. Darlene was an only child in her family of origin. She is now a widow, lives alone, and has one grown son. She has been a recovered alcoholic for over thirty years. Earlier in her life, Darlene was a meat wrapper, until she was disabled following a back injury. Prior to hospitalization, she functioned within her community as an evangelical person, bringing "word of the Lord" to people on the street. During her hospitalization, she, in fact, called upon God for help, prayed aloud to *Him*, read her Bible for support, and occasionally sang hymns to *praise* Him. She held the firm belief that we are all brought to

goodness, achievement, health and happiness only through the grace of the Lord.

Darlene's pain intensity scores were significantly lower for PPW than for NPW ($p < .001$). Her MPQ PRI was higher for NPW than for PPW. She expressed a preference for PPW, with Likert scores of 4 for PPW and 0 for NPW. Her advice for a friend was to try PPW and then decide. The reason she gave for preferring PPW was that she experienced less pain when she washed herself.

Darlene's pain management was complicated by her respiratory intolerance to opioids, by a possible stroke or persistent transient ischemic attack near the mid-point of her hospitalization, and by her age. Her pain management during NPW was difficult because of her loudly-voiced verbal declamations, prayers, pleading and crying, causing staff nurses to attempt to get her dressing changes over with quickly, using two or three persons whenever possible. Consequently, her pain intensity was high, with a fairly short pain duration. Nurses who performed her dressing changes appeared not to enjoy the experience at all, verbalizing how exhausting it was to do wound care for this patient. After the dressing change, both patient and nurses appeared stunned.

Darlene was a fair candidate for PPW, because although she self-washed slowly but surely, she could reach only her burned arm and some of her side; her leg burns were beyond her reach. For the areas she could reach, PPW was less painful than NPW of the same areas. She was very apprehensive about pain and tended to verbalize her fear during the dressing change in the same manner

she verbalized her pain, making it difficult for the nurses to tell when she was in pain and when she was fearful. Some nurses remarked that Darlene seemed to confuse pain and apprehension, exhibiting global misery during dressing changes.

Eleanor. Eleanor is a 35-year-old kindergarten teacher who was injured during an unusually cold winter when the tank supplying propane for heating to her home exploded, destroying the home. Her boyfriend, and her son by a previous marriage, were also injured in the accident; her boyfriend was treated as an outpatient for his burns and bruises, and her son was hospitalized for a femur fracture and placed in traction in a different hospital. Eleanor was burned over 5% of her body, 1.5% of which was full-thickness, necessitating one surgery for skin-grafting. She was hospitalized seven days, during which time she communicated to her son only by telephone. In her home of origin, Eleanor was the second of three children.

Eleanor's account of the accident includes the chilling fact that after the explosion, she could not locate her son, who was unconscious and buried under layers of rubble. Eleanor sent her boyfriend for help, while she searched through pieces of wood, and plaster, and fluffy and fluttering handfuls of insulation, hoping to find her son. She called and called, receiving no answer, while the flames became hotter and hotter. "That's it," she thought, "I've got to get out of here, or else I'm going to burn to death." Then she realized, "No, I'm not leaving without my son. If I don't find him and get him out of here, I'll die with him, trying to find him." She

remembered feeling more peaceful as soon as she made that decision. She shouted his name again, yelling, "Please make a noise, honey; you've just got to make a noise so Mom can find you," and then she heard a noise.

In the hospital, reconstructing what must have happened, Eleanor found she had blisters at the tips of her fingers and underneath her nails, probably from clawing at the burning debris trying to rescue her child. She made her way to the direction of the noise, and she felt her son. She began to drag him out of the exploded building. "I felt so surprised," she said, "because I had always heard that with a life-threatening accident, people have the strength of ten. I was pulling him, and pulling him, and he was so heavy, and I was so weak. I thought, 'Where is my strength of ten?'"

Finally Eleanor succeeded in getting her son outside. She said, "Before the accident I believed that there was a God. Now I know that there is a God."

Eleanor's pain intensity scores were significantly lower for PPW than for NPW ($p < .001$). Her MPQ PRI was higher for NPW than for PPW. She expressed a preference for PPW, with Likert scores of 4 for PPW and 0 for NPW. Her advice for a friend was to choose PPW. The reason she gave for preferring PPW was that it was less painful than NPW. Eleanor said that if she had realized at the beginning of hospitalization what she knew by the end, she would have insisted on doing as much of her burn care as she could, leaving only the things she couldn't do for the nurses to finish up.

Eleanor had been involved in an accident that destroyed her home and all her possessions and endangered her son's life. She experienced not only physical pain but also the pain of loss of optimism, the knowledge that horrendous events can occur, even if one is careful and clever and wise and foresighted and a good citizen. Near the end of hospitalization, Eleanor said that she didn't think she could face any more pain in her life, not even small pains. PPW allowed Eleanor to diminish her physical pain. It also imparted a level of control to her life in the hospital.

Frank. Frank is a 48-year-old man who makes his living as a free-lance painter. He was lacquering cabinets on the job in a small medical office, and there was an explosion, probably caused by an open pilot on a water heater. He was burned over 17% of his body, all partial-thickness injury, and was hospitalized for six days. He did not require skin-grafting. Frank is the sixth of six children in his family of origin. He is married and has five children.

Frank's pain intensity scores were significantly lower for PPW than for NPW ($p < .001$). His MPQ PRI was higher for NPW than for PPW. He expressed a preference for PPW, with Likert scores of 4 for PPW and 2 for NPW. His advice for a friend was to choose PPW. The reason he gave for preferring PPW was that he could tolerate pain better when he was in control.

On Day 3 of data collection, during NPW, Frank was observed to try to regain control of the dressing change by giving verbal directions to the nurse washing his burns, relative to direction and style of washing. On Day 4 of data collection, during PPW, he did as

much of his own washing as he could conveniently reach. Then, when the nurse was finishing up hard-to-reach areas that were eliciting a pain score of 10, he took the washing sponge back from her and finished the areas, with scores of 7.5. He also coached the nurse during Silvadene application, saying "Put the cream on really thick. We tried it last night and it really helps," and "Wrap them looser - then it really hurts less when you move." The use of "we" in the first quote indicates that the subject had experienced at least a feeling of collaboration with the evening nurse in decision-making and physical execution of the dressing change. In the final interview, Subject 6 related grabbing a nurse's arm during a later NPW dressing change (not a data-collection day) when she hurt him. She shook free and shouted, "Don't you ever do that again," to which he replied, "Don't you ever do that again." Frank had established control of his dressing change washing.

Gilbert. Gilbert is a 37-year-old man burned with gasoline, possibly in a suicide attempt, but certainly while depressed over domestic difficulties. He was burned over 27% of his body, with 10% full-thickness burn injury necessitating one skin-grafting, and was on the ventilator for the first few days of hospitalization. He was hospitalized a total of 13 days. He is the fifth of nine children. He currently lives with his common-law wife of nine years and her two children. His two natural children live with their mother. He works as a lineman and is currently employed. He has a history of drug use in his teens but not as an adult. He has a history of heavy alcohol use until he was 29 years old and does not use alcohol now.

Gilbert's pain intensity scores were significantly lower for PPW than for NPW ($p < .005$). His MPQ PRI was higher for NPW than for PPW. He expressed a preference for PPW, with Likert scores of 4 for PPW and 0 for NPW. His advice for a friend was to choose PPW. The reason he gave for preferring PPW was that the pain was more predictable and therefore less intense.

Gilbert was intubated during the early part of his hospitalization and was also begun on paralytic agents to prevent loss of his endotracheal tube, which had been placed on admission for a compromised airway. His earlier burn dressing changes, consequently, were all performed by nurses, but Gilbert did not have the opportunity to speak or even to move. After extubation, Gilbert assumed responsibility for washing his own burned face, and later his neck. During his exit interview, he expressed sadness over his loss of normal appearance and verbalized fears that strangers would look at him as a monster. It is inevitable that strangers will stare at him: Gilbert suffered a neck injury ten years ago and as a consequence has a very rigid neck; this in combination with his height of 6'8" guarantees than he will turn heads. His facial scars do not promise to be severe, and the appearance of his face will approach normal in three to six months. However, his interpretation of the scrutiny he evokes may be focused more upon scarring than upon his extreme height and somewhat immobile neck. Gilbert was in a depressed state prior to admission. At first admitting to suicide, he later denied that his injury was self-inflicted.

During his hospitalization, Gilbert was at first totally disenfranchised, because of the necessity for paralyzed ventilation. After he became able to perform some of his own care, he welcomed the ability to self-wash his face, explaining that when the nurses washed him, he never knew what direction they'd be coming from or where the pain would occur. The increase in predictability with PPW was a welcome change.

Henry. Henry is a 24-year-old man who was injured while being a Good Samaritan. He was working as a landscape gardener, but had formerly been employed in construction and carpentry. The gardening crew arrived at a residence in the morning, and there was a grease fire in the kitchen. Henry rushed inside to put out the fire and his clothes caught fire, with some grease splattering on his chest, as well. He was burned over 18.5% of his body, with a 8.5% full-thickness burn injury requiring one skin-grafting. His hospital stay was ten days. Henry is third of four children. He denies alcohol and drug abuse, although he admits to light alcohol and occasional marijuana use.

Henry's pain scores were significantly lower for PPW than for NPW ($p < .001$). His MPQ PRI, however, was the same for both NPW and PPW. In accordance with the PRI, his personal preference was mixed: PPW was preferred for his neck, jaw and face, with Likert scores of 4 for PPW and 0 for NPW; NPW was preferred for his chest and arm, with Likerts of 4 for NPW and 0 for PPW. His advice for a friend was to try PPW. The reason he gave for preferring NPW for his chest and arm was that he knew that he couldn't cause himself as

much pain as the nurses did, and his belief was that his self-washing would be inadequate if the pain were not as severe as with NPW.

Henry was an unusual patient, somewhat flat in affect, somewhat like Chris. Like Chris, Henry had a history of a serious head injury which had resulted in a three-day coma. It was sometimes hard to determine if Henry was joking or serious, saying unusual things like, "I've been in pain all morning. My nurse has been ignoring me."

It is possible that Henry was appalled by the results of trying to do a good deed and was undergoing his own existential struggle, trying to sort out the balance of fairness in the world.

Ira. Ira is a 38-year-old man burned in a flash injury in which gasoline ignited while it was being poured into a carburetor. He was burned over 16% of his body, all partial-thickness. He was hospitalized for four days. He was an only child raised by grandparents, in an abusive home. He has one grown child. Ira lives with his girlfriend now. They are both homeless. He formerly drove a concrete truck but is now unemployed, supporting himself through thieving. He prides himself on never stealing from individuals, only taking equipment or supplies from companies. He is a heroin addict and an alcoholic. She is a former addict, now on a methadone program.

Ira's pain scores were significantly lower for PPW than for NPW ($p < .05$) and his MPQ PRI was higher for NPW than for PPW. His personal preference was for PPW, with Likerts of 4 for PPW and

0 for NPW. His advice for a friend was to try PPW. The reason he gave for preferring PPW was that he preferred to be in control.

Ira verbalized wanting to get off heroin and was started on methadone during his hospitalization, transferring to an outpatient methadone program after discharge from the hospital. He was very concerned with his appearance, saying that before his accident he was a very handsome man, and he was also concerned with how nurses would view him, since he was a known addict.

Ira was a complex man, and a complex patient for nurses to address. PPW provided an obvious transition to the self-care that he would assume upon discharge and may have provided him some self-respect, as well. He was one of the two patients who washed themselves to the bleeding point, perhaps in order to acquire respect from nurses.

John. John is a 35-year-old man, burned when gas he was pouring into equipment at work flashed back onto his shirt and ignited it. He was burned over 32% of his body, with 10% full-thickness injury, and was skin-grafted once. He was hospitalized 16 days, a short span of time for such a large burn. He works as a painter. He is seventh of nine children in birth order. He is currently married and has three children. He neither drinks nor uses drugs. John is also a minister and belongs to the Free-Will Baptist Church. His religion is a very serious matter with him.

John's pain scores were significantly lower for PPW than for NPW ($p < .001$), and his MPQ PRI was higher for NPW that for PPW. His personal preference was for PPW, with Likerts of 3 for PPW and

1 for NPW. His advice for a friend was to do PPW and to do as much of his own washing as he could do. The reason he gave for preferring PPW was the control it gave him.

John was one of the four most articulate subjects in discussing his hospitalization. He admitted to the nurses on admission that he has a very low tolerance for pain, which was noted by staff during his dressing changes. He described his dressing changes in terms not only of pain but of the dehumanizing and humiliating experience of being stripped naked. He seemed to object to the depersonalization of burn dressing changes and was adamant that the nurses who paid attention to his requests for time-outs caused him less pain than those who ignored him and kept on washing. Like Frank, John also was observed to grab a nurse's wrist when she persisted in washing during the NPW dressing change and did not appear inclined to pause as requested. To her request to not grab her clean gloves, he replied, "I didn't grab your hand, I grabbed your wrist." Control seemed very important to John. If he didn't have it, he manufactured it.

CHAPTER 6

DISCUSSION

Epidemiological overview

Although the ten subjects studied were not randomly selected from the population of all adult burn victims in the United States, the subjects are fairly typical of the burn population, as a whole. The burn population in the United States is tri-modal (Edlich, Attinger, Antharvedi, Ruffin & Haynes, 1984), with one childhood peak and two adulthood peaks. Approximately 70% of burn victims can be classified into one of these three peak groups; approximately 50% of adult burn victims can be classified into one of the two adult peak groups. The childhood peak occurs during the second through fifth years of life when children have acquired mobility and curiosity but have not yet absorbed enough information about the environment to protect themselves against the dangers associated with hot liquids and objects. The first adulthood peak involves males who are approximately 18 through 35 years of age. The last peak occurs in adults 60 years of age and older. Theoretically, burning in the late middle aged and elderly population can be related to either physical or mental changes associated with aging (personal communication, Anne Missavage).

Of the ten subjects studied, six belonged to the above age groups at risk. The four "outliers" were a 35-year-old woman, a 48-year-old man, a 37-year-old man, and a 38-year-old man. The one elderly woman in the sample was a typical member of the elder

group of burn patients in that she was burned in a kitchen injury, when her nightgown caught fire as she was cooking.

Darko, Wachtel, Ward and Frank (1986a, 1986b) described burn patients as often involved in antisocial or self-destructive activities (21% incidence), often intoxicated (16% incidence), and often on public aid (32% incidence) or making $5,000 to $10,000 yearly (28% incidence). In general, the ten subjects in this study conformed only in part to Darko et al.'s (1986a, 1986b) description. One subject had an antisocial lifestyle (10% of this sample) in that he was a heroin addict and supported himself by thieving. Another subject had been burned in what might have been a suicide attempt (10% of this sample). The other subjects, however, did not manifest antisocial or self-destructive activities. None of the subjects were intoxicated at the time of burning. Two subjects (20% of this sample) were unemployed at the time of their accidents, fewer than Darko et al.'s (1986a) sample, and two were receiving disability benefits (20% of this sample) when their injuries occurred.

There are various explanations of why the ten subjects differed from the population Darko et al. (1986a, 1986b) described, in terms of alcohol abuse and of antisocial and self-destructive activities. Darko et al.'s (1986a, 1986b) sample included both inpatients and outpatients, and this study included only inpatients with small- to moderate-sized injuries; it may well be that burn victims who have either small or enormous burns better fit Darko et al.'s (1986a, 1986b) criteria of the typical burn patient. This study's exclusion criteria eliminated one subject who was indeed involved in risk-

taking activities, manufacturing methamphetamines, and was arrested soon after the explosion of his meth lab; his status as a prisoner excluded him from this study. Another reason this study's subjects differed from Darko et al.'s (1986a, 1986b) typical burn population is that this study's ten subjects were drawn from a different geographic area which may exhibit a different distribution of alcohol abusers, and possibly of persons engaged in antisocial and self-destructive behavior, than did Darko et al.'s (1986a, 1986b) sample.

Pain Intensity Scores

NPW Compared With PPW

Differences in pain intensity. It has long been accepted in clinical practice with burn patients that their pain while self-washing (PPW) is less intense than when washing is performed for them (NPW), and the literature reflects this commonly-held belief (Wagner, 1984). However, until this study there was no subject-reported empirical evidence that PPW was less painful than NPW, nor was there a measure of how much difference existed between groups and whether or not that difference was statistically significant.

The fact that all of the ten subjects, even those who preferred not to self-wash, produced concurrently-obtained intraprocedural pain scores that were significantly lower on PPW days, as compared with NPW days, supports the belief that self-washing is less painful than nurse-performed washing for burn patients. Moreover, self-washing is less physically painful, as opposed to the condition of

being merely preferred by subjects, since preference could imply a measure of decreased emotional or psychological pain, as well. This finding of a decrease in reported procedural burn pain parallels Tarnowski et al.'s (1987) findings of a decrease in observed procedural burn pain with self-mediated as opposed to therapist-mediated debridement in a 12-year-old boy and Kavanagh's (1983b) and Kavanagh et al.'s (1991) findings of decreased observed procedural pain behaviors with self-washing as opposed to staff-performed washing in children.

Theoretical causation of decreased pain with PPW as compared with NPW. Theoretically speaking, the question of why PPW is less painful than NPW remains unclear. In relation to the gate-and-coping framework, the significant difference between PPW and NPW in terms of pain intensity scores may have been due to decreased or altered peripheral nociceptive contribution, may have been due to peripheral large-fiber inhibitory recruitment, may have been due to descending inhibitory control, or may have been due to a combination of one or more aspects. It is possible that PPW's efficacy in producing lower pain intensity was due to different aspects in different subjects.

This probable difference of causation in different subjects is supported by interviews, clarifying subjects' reasons for finding PPW preferable to NPW. (Although Subjects 1, 3 and 8 also found PPW less painful than NPW, their basis for the finding is necessarily peripheral, since descending inhibitory control seems linked with preference; for this reason Subjects 1, 3 and 8 are not discussed here

relative to the issue of causation.) Subject 2 clearly identified that adapting his technique was the reason PPW was more effective for him, which implies peripheral causation, perhaps both a decrease or change in nociceptive input and a recruitment of large-fiber inhibitory afferents; Subject 2's preference was for a medium pressure for washing, implying that large-fiber involvement was involved in decreasing his pain. Subject 4 stated a preference for washing that was gentler and slower than that of the nurses, implying that, for her, minimizing both the number of small-fiber nociceptive afferents that were activated and decreasing the frequency of nociceptive discharge were the reasons PPW was less painful than NPW for her. Subject 5's preference was based on her observation that she could perform the necessary debridement and washing and cause herself less pain than did the nurses, and it is not clear if the decreased pain was due to a mixture of descending inhibitory control and peripheral input, or solely to altered peripheral input, using her own personal technique. Her own technique decreased small-fiber nociceptive afferent input but most likely did not include a measure of large-fiber inhibitory modulation, because this subject preferred a light touch with self-washing. For Subject 7, the decrease in pain he noted with PPW seemed to be related to a decrease in fear and also to the different frequency of nociceptive impulses produced when he washed more slowly than did the nurses, making his dressing change last longer but produce less intense pain; both descending inhibitory control and altered small-fiber nociceptive input were apparently involved.

The issue of being in control arose for several subjects. However, it is not certain whether their choice of the word control implied control over the predictability of the dressing change, which would result in descending inhibitory control modulation, or control over the technique of the change, which is related to peripheral input, potentially both small-fiber nociceptive and large-fiber inhibitory. For Subject 6, who noted that it was easier to tolerate self-induced pain than other-induced pain and who was observed to self-debride more vigorously than the nurses, it appears likely that the principal source of PPW's benefit in pain reduction was rooted in descending inhibitory control. For Subject 9, who also debrided more vigorously than the nurses, the source of PPW's ability to decrease pain appeared to be descending inhibitory control. For Subject 10, his own expertise during the dressing change in relation to being able to debride more effectively than the nurses, with less pain and bleeding, played a part in his preference, although decreased apprehension about being hurt was also a factor. Both descending inhibitory control and peripheral input seemed to be operating for him, and within the category of peripheral input, both the decrease in small-fiber nociceptive afferent input and the increase in large-fiber afferent input appeared important, in that this subject remarked that he could wash himself more firmly than did the nurses.

Ranges and Distribution of Pain Intensity Scores

The range of scores from 0 to 10. It would be expected that subjects as a group would report pain scores ranging from 0 to 10

over the course of hospitalization, as they indeed did. Numerically, it might seem that the difference between PPW and NPW scores was chiefly derived from the large number of 10s present during NPW washing. However, the fact that the mean of all low pain scores was less for PPW than for NPW suggests that a lower-positioned range within the span of possible scores exists for PPW as compared with NPW, even when 10s are disregarded, supporting the supposition that PPW is less painful than NPW across the dressing change, rather than only at times of peak pain.

Since burn patients are known to report that their pain is far in excess of anything ever previously experienced (Fagerhaugh, 1974), one would expect the score of 10 to occur. The score of 10 was reported by eight of the ten subjects during dressing change washing. The two subjects who did not report the score of 10 during data-collection dressing changes were at the end of their hospitalizations, one with unhealed facial burns and one with unhealed facial burns and an unhealed area of approximately 2% TBSA on the side of his neck; both had experienced pain they described as 10 in prior dressing changes.

One would also expect the score of 0 to occur, but possibly not to occur during washing, since Perry et al.'s (1981) subjects reported that their pain <u>at rest</u> was none to slight in most cases. Six subjects reported scores of 0 after premedication but before the beginning of the dressing change. This reporting of pain scores of 0 implied that patients' baseline pain had been relieved after the premedication for the dressing change had been given.

Four subjects reported zero pain during some of PPW, however, but not during NPW. This finding for PPW is quite different from Perry et al.'s (1981) report that pain during dressing changes was moderate to excruciating for most subjects. It is probable, therefore, that Perry et al.'s (1981) subjects' dressing changes were performed under NPW conditions.

There was a peculiar paucity of 10s in PPW pain intensity scores, as compared with NPW scores. The most common pain intensity score recorded during NPW was, indeed, 10. It is possible that, during PPW, subjects reached 8s or 9s and then self-corrected their technique to avoid 10s altogether. During NPW, no such correction was possible. Short of refusing further NPW, the only strategies for avoiding pain observed in subjects were pulling back, verbally guiding the nurse through the washing, requesting more pain medication and enduring the experience. Pulling back was countered verbally and sometimes physically by the nurse; verbally guiding the nurse was not used by subjects until they became adept themselves at washing; requesting more medication was limited by the amount of medication ordered and by the amount of medication nurses judged prudent and appropriate to administer. Because of their many years of experience, nurses tended to medicate patients according to a predetermined level of what was customary for the average patient, until individual patients became familiar to the nursing staff and their personal and physical tolerances were evident. Only four of the ten study subjects were hospitalized for more than nine days, and so by the time their personal peculiarities

of pain tolerance and medication needs were discovered, they were almost healed.

Another explanation of the difference in occurrence of 10s is the difference in arousal during PPW versus NPW. Arousal is the amount of internal tension, excitement, anxiety or interest present in relation to a situation or scenario. Eysenck (1982) described arousal's contribution to performance. In low-arousal states, characterized by lack of attention and focus, performance is likely to be limited. In high-arousal states, characterized by anxiety and diffuse energy, performance is likely to be limited, as well, because focusing is difficult. Corah (1973) found that pedodontic subjects experienced lower arousal during an intense pain-filled experience if they were given control over the experience. It is possible that the dearth of scores of 10 seen during PPW was reflective of lowered arousal. Performance, embodied during the dressing change as endurance and tolerance of pain, deteriorated under high-arousal conditions.

Adherence to normal distributions. A limitation to assuming that all NPW and PPW pain intensity scores in burn patients adhere to the above distributions arises from the expectation that NPW pain intensity scores and PPW pain intensity scores should be more or less normally distributed. After clustering of scores to the nearest whole number, with all halves rounded up to the next whole number, PPW pain intensity scores conform to a bell or bi-modal bell, if zero scores are discarded. However, NPW scores do not assume a bell

shape after rounding but instead form a steeply-rising curve that peaks with the scores of 10, which represent the mode.

An explanation of this finding is pain's unpredictable and changing nature. In asking subjects to rate pain from 0 to 10 during an ongoing experience in which pain is expected to fluctuate both moment to moment and quite possibly over days, one limits the rating by the endpoints of the scale. The cluster of 10s during NPW implies a limitation of responses, in that subjects who responded with 10s when their pain scores were elicited might have preferred to use higher numbers, had the numbers been available, and indeed some subjects implied that their pain was so intense that had more numbers been available they would have been likely to use them. Their pain intensity exceeded what they would have expected to occur in their initial imagining of how intense pain could be. In fact, scores of 10 may represent some 11s, 12s, 13s, and so forth.

The McGill Pain Questionnaire

Association of the MPQ with pain intensity scores. The MPQ is believed to measure sensory, affective, evaluative and miscellaneous components of the pain experience. However, the evaluative subscale of the MPQ, which consists of only one group of descriptors (annoying, troublesome, miserable, intense and unbearable), was most closely correlated with the pain intensity score. This finding is best explained by the fact that the evaluative subscale of the McGill is most closely related to intensity.

The MPQ's pain rating index, the PRI, is purported to be an accurate measure of pain intensity. However, in this study, mean

daily pain intensity scores and the MPQ's PRI were not significantly correlated. This finding is best explained by that fact that the MPQ is a retrospective instrument, administered not during the pain experience but after it is over, whereas pain intensity measures were obtained concurrently with the pain experience. When examining procedural burn pain, the evaluative subscale of the McGill may be a more accurate retrospective measure than the PRI.

A second explanation of the MPQ PRI's inability to duplicate pain intensity scores is the fluctuating nature of procedural burn pain. Pain scores showed considerable fluctuation during the dressing change, presumably paralleled by changes in pain quality, since summing of descriptors yields the PRI. However, the administration of the MPQ after the dressing change forced subjects into a decision regarding the quality of pain (i.e., was the pain intense more often than not during the dressing change?). This mental averaging may have produced the lack of correlation between pain intensity scores and the MPQ's PRI.

A third explanation derives from the fact that the burn subjects in this study were medicated, with opioids and sometimes with benzodiazepine anxiolytics. Although amounts of anxiolytics administered were within the antianxiety and not the hypnotic range, the small amounts administered could conceivably have resulted in subjects' forgetting some of the particulars of their pain experiences during the time that elapsed between the end of the washing part of the dressing change and the subsequent

administration of the MPQ. The opioid medications used may have affected subjects' affective responses to pain.

Any of the three explanations argues against the MPQ's ability as a whole to measure pain intensity accurately for procedural burn pain, despite the fact that the MPQ is used and its PRI computed in burn research (Charlton et al., 1983; Choiniere et al., 1989; Miller et al., 1992; Sandidge, 1989).

The MPQ and descriptors chosen. The MPQ's descriptors are arranged in groups of two to six words. Choice of a certain word within a group eliminates the other words in that group from selection. Within groups, words seem related and are graded in severity as one proceeds down each word group: the third group, for instance, is pricking, boring, drilling, stabbing, lancinating. Choice of a descriptor from each group of words is optional: subjects were instructed to choose none of the words within a group, if none of the words described their procedural pain.

Exhausting was the descriptor most commonly used by subjects to describe PPW pain and to describe procedural pain, in general. Stinging was the descriptor most commonly used to describe NPW pain. In choosing exhausting from the eleventh word group of the MPQ, subjects negated that their pain was only tiring. In selecting stinging from the eighth group, subjects negated that their pain was merely tingling, itchy or smarting.

The first group of descriptors in the MPQ is the largest, containing six words. Although no single word in this first group was chosen in more than a fourth of the MPQs, subjects chose one of the

six words from this sensory group a total of fifteen times, implying that procedural burn pain is flickering or quivering or pulsing or throbbing or beating or pounding three-fourths of the time, as often as it is either exhausting or tiring. An absolute word count for the MPQ can be deceptive. The two groups which elicited the largest number of responses, 17 of 20, were two of the sensory groups, the eighth group (tingling, itchy, smarting, stinging) and the ninth (dull, sore, hurting, aching, heavy). All ten subjects chose a word from the eighth group to describe NPW. All except one of the subjects chose a word from the ninth group to describe PPW. And all except one subject chose a word from the sixteenth group (annoying, troublesome, miserable, intense, unbearable), the sole evaluative scale, to describe NPW.

Choiniere et al. (1989) used the MPQ to describe procedural burn pain. It is likely in Choiniere et al.'s (1989) study that all dressing change procedures were performed by hospital staff, making comparisons between its results and the findings of this study's NPW descriptors possible. However, comparison of Choiniere et al.'s (1989) descriptors with the descriptors used by this study's subjects for NPW pain revealed a major difference in words selected. More than 50% of Choiniere et al.'s (1989) subjects chose the descriptor tiring. Between 40% and 49% of Choiniere et al.'s (1989) subjects chose the words jumping, pulling, beating and tender. Between 30% and 39% of Choiniere et al.'s (1989) subjects chose the words pricking, annoying, nagging, sickening, sharp, burning and wretched. In contrast, more than 50% of the subjects in this study

used the descriptors stinging, exhausting and piercing for NPW pain. Descriptors shooting, sharp, wrenching, searing, hurting, sickening, fearful and tearing were used by 40% of the subjects in this study, and 30% used the words throbbing, burning, tender, punishing, intense, unbearable, tight, cool and dreadful to describe NPW pain. Of the 20 words chosen in this study by 30% or more of subjects, and of the 12 words that 30% or more of Choiniere et al.'s (1989) subjects chose, only four descriptors are common to the two studies: sharp, burning, tender and sickening, and none of these are among the three most frequently chosen in either study.

The difficulty in comparing the results of this study with Choiniere et al.'s (1989) findings may be due to language differences between French and English. Thirty-seven of Choiniere et al.'s (1989) 42 subjects were French-speaking, and the MPQ was translated into French for their use. Due to the difficulty in applying descriptors across languages, it is doubtful whether Choiniere et al.'s (1989) findings can be legitimately applied to an English-speaking burn population.

The MPQ and descriptors not chosen. It is possible that any retrospective measure fails to capture the intensity and the almost surreal nature of procedural burn pain. Subjects did not select the five descriptors cramping, splitting, killing, spreading and numb. It is probable that cramping, splitting, spreading and numb are not appropriate descriptors for procedural burn pain, but it is equally possible that other descriptors within the groups that contained these four descriptors were better at defining burn pain than were

these four. The descriptor killing was not selected by any of the ten subjects. It is within the group of affective descriptors that also includes punishing, grueling, cruel and vicious, which precede it and which might have been chosen by subjects because they describe procedural pain better than does the descriptor killing. It is also possible that subjects' estimate of the value of the regional burn center in providing the best possible treatment for their injuries made it impossible for them to use the descriptor killing because its use could imply that nurses are the vehicles and the willing inflictors of pain so severe that it could kill. A further confusion in subjects' minds might have been created by the genuine warmth of the members of the burn unit nursing staff: caring nurses aren't involved in killing pain. Thus, the emotionally charged descriptor killing was never used. The descriptor torturing was used by only one subject, in relation to both NPW and PPW; he was quick to point out that the pain was torturing pain only because of the recriminations he was causing himself, relative to the burn and to his life in general. This explanation, in effect, may have been an attempt by the subject to exonerate the nursing staff from any implication that they were torturing him. The other nine subjects avoided using the descriptor torturing, even though more than one subject hesitated over the adjective, ultimately not selecting it; reasons for not selecting the adjective may be the same as the hypothesized reason that the descriptor killing was avoided.

Sensory, affective and evaluative components of pain. The MPQ's twenty descriptor groups fall into four categories: sensory,

affective, evaluative and miscellaneous. The ten groups of sensory descriptors are most closely related to the actual intrinsic painfulness of an experience. The five groups of affective descriptors are most closely related to suffering, or the emotional reaction to pain; it is probable that they also equate with subject preference. The single group of evaluative descriptors equates with the gestalt or wholeness of the pain experience, and may also be equated with quantitative measures that give a single rating of the pain of the experience, such as a 0-to-10 intensity scale. The four groups of miscellaneous descriptors do not have a direct counterpart within this research study.

It is not known whether decrease in pain intensity scores with PPW versus NPW represented a sensory, an affective, an evaluative or a total pain perception, despite the correlation between mean pain scores and the evaluative subscale of the MPQ. However, a decrease in sensory, affective and/or evaluative PRI subtotals was noted between NPW and PPW conditions. The instructions given to subjects relative to rating their pain intensity requested them to score their pain, with 0 representing no pain and 10 representing the worst pain imaginable, giving no cues relative to sensory, affective or evaluative components. It was anticipated that, during painful parts of the rapidly-moving dressing change, it would be all that subjects could process to give a single number.

It seems probable that 10s during NPW represented 10s in all of the components of the pain experience, sensory, affective and evaluative. When patients screamed, swore or prayed, they

appeared to experience maximally noxious sensory input, they tremored, they were clearly suffering, they were communicating a strong dislike of the experience, and they were, in general, miserable. In the MPQs that subjects completed after NPW and PPW dressing changes, subjects used the top sensory words slightly more than twice as often for NPW as for PPW; eight of the NPW dressing changes contained the pain intensity score of 10, but only one PPW change contained a pain intensity score of 10, so sensory distress was indeed implied. However, affective responses of crying, swearing and praying occurred with the score of 10, implying an affective component. Evaluative responses, in general, showed a positive correlation with mean pain intensity ratings.

It is not known whether scores of less than 10 represented sensory, affective or evaluative distress. However, the two subjects whose intensity scores never reached 10 on data-collection days both had lower total PRI scores for PPW than for NPW, and both had subscale scores in which PPW was lower than NPW for sensory, affective and miscellaneous components. One subject rated the evaluative component of pain lower for PPW than for NPW, and one rated the evaluative component zero for both days. These findings indicate that for scores less than ten, there may be components of sensory, affective and evaluative distress. Another subject did try to separate out the different components of pain, when he remarked after additional intraprocedural opioid medication that it hurt the same but didn't bother him as much; his response seems to be a statement of unchanged sensory input but decreased affective or

evaluative response. His pain intensity scores remained unchanged after administration of the medication, as did his estimate of "hurt," so for him it appears that pain scores represented the sensory aspect of pain, at least on that one day, for that particular segment of 8.5-scored PPW.

Subject Preference and Advice to a Friend

Subject preference. Subject preference for NPW was a function of increased pain associated with the physical position needed for performance of PPW, a conviction that nurses were more competent than oneself in delivering burn care, or self-assessment of inability to hurt oneself as much as would be necessary to accomplish adequate washing. Subject preference for PPW was a function either of decreased pain or of increased control.

All but two of the subjects who preferred PPW also commented, however, that they thought the nurses performed wound care better than they did. With the years of experience each of the day shift nurses possessed in burn care (and subjects did ask how long nurses had worked in the unit), it would be ridiculous to assume that the subjects were as competent as the nurses. The existence of a regional burn center, to which many of the subjects were transported by ambulance or helicopter, implies competency in a special area, not even able to be mastered by health care professionals in outlying centers, much less by individual subjects. The mystique of wound care was large and magical, working at counterpoint to nurses' urging subjects to try to self-wash on PPW days as much as possible. However, when subjects performed PPW

with nursing tutelage, it became apparent that the task was able to be performed at least in part by the subjects themselves.

The weak negative correlation ($p < .10$; $r_s = -.4824$) between Likert scale preference scores for NPW and the number of times subjects washed their burns, and the lack of correlation ($p > .10$; $r_s = .2908$) correlation between Likert scale preference scores and number of times subjects washed, may indicate that with more experience, subjects began to be averse to NPW. It is interesting that the negative impression of NPW emerged but a corresponding positive impression of PPW did not necessarily accompany it.

A possible interpretation of this finding is that most subjects preferred PPW to NPW, but apparently they were choosing between two evils, in a situation of cognitive dissonance (Festinger, 1957) produced by two alternatives, each possessing potential loss. Subjects learned that dressing changes, with attendant pain, were essential for their recovery. Conflict and tension arose because pain was severe and imminent recovery unachievable. [Repeated engagement in a negative behavior, such as enduring the dressing change, magnifies the dissonance aroused (Brehm & Cohen, 1962)]. Additionally, the apparently contradictory identity of the nurse as both caregiver and inflictor of pain contributed to subjects' dissonance. The nurse-patient relationship was predicated upon provision of comfort, from the subjects' perspectives, but when the burn nurse performed dressing changes, conflict and tension were magnified: with further experience of NPW, subjects committed more strongly to their aversive stance toward NPW.

Control as it relates to dressing change washing preference. For three of the subjects who preferred PPW, control was the reason for their stated preference. Control evidently was welcome, supported and within their expectations as patients in a burn unit. However, control as a reason for preferring a certain kind of dressing change is not limited to preference for PPW. Folkman's (1984) observation that control over a situation may decrease or increase stress, because increased control implies increased responsibility for a stressful situation, can also apply to subjects who preferred NPW for some or all of their burned areas. Introduction of control can change a stress appraisal (Folkman, 1984). However, the stress appraisal can change in the direction of challenge, as it appeared to do for subjects who preferred PPW and became involved in perfecting their technique, or it can change in the direction of threat, for subjects who preferred NPW. For the subject who preferred NPW because of his belief that the nurses were more equipped to perform the dressing change than he was, his stress augmented with the increased responsibility of performing his own dressing change. Folkman (1984) also observed that coping may be negatively affected in conditions in which enhanced control is unsupported; with increased and especially enthusiastic coaching, provided over a period of days, the subject above might have perceived more support and found PPW less stressful. For the subject who preferred PPW for less painful areas and NPW for more painful areas, saying that he couldn't physically hurt himself as much as needed to be done, causing himself pain

beyond a certain point while performing PPW increased his stress sufficiently to make NPW a less stressful option.

Gate-and-coping framework conceptualization of subject preferences. Within the gate-and-coping framework, reasons for preference of NPW seemed to involve peripheral nociceptors for one subject, specifically more physical pain due to tourniqueting, and descending inhibitory control for the other subjects, namely feelings of uneasiness with PPW, due to doubts about competency or aversion to self-inflicting pain. Within the gate-and-coping framework, reasons for preference of PPW seemed to involve the ability to enact the problem-focused strategy of creating a different and flexible washing technique. However, Subjects 6, 7 and 10 also seemed to be enacting the emotion-focused strategy of reinterpreting the washing experience in a way that caused them less fear, apprehension or uncertainty. Although not critical of nursing staff, Subject 7 stated, "A burn victim - there's a lot of hurt there - nurses and doctors just can't know the pain unless they're burned. Anybody in the world can feel sorry for you but they can't know what you feel."

Advice to a Friend. All except one subject voiced the opinion that if a friend were burned, trying to self-wash would be advised, at least in some cases. This may be a function of our society's larger involvement in self-directed health care activities and the assumption of responsibility for a healthy lifestyle, or it may reflect nine of the ten subjects' aversion to the pain of NPW.

Each subject considered individually. Because pain is a subjective, personal and completely unique experience for each

individual, the meaning of the whole pain experience to each subject is important to fathom. Similarly, each patient in a burn unit is different - in location of burns, in pain tolerance, in aversions, in physiologic variables, in preference of style of washing. The decision to make PPW available to patients is emphatically not a decision to impose PPW upon all subjects for all dressing changes, overruling patient preference.

Pain Medications and Efficacy of Washing

Internal Validity

The internal validity of this study depends upon providing evidence that the difference in pain that subjects experienced is due to the different treatment: NPW versus PPW. Alternatives to this explanation are 1) that washing was not as effective with PPW, and 2) that more medication was administered for PPW. Neither alternative explanation was substantiated. Washing efficacy was evaluated by blind raters, and no difference was detected between NPW and PPW thoroughness ($p < .05$). Medication administration during dressing changes, for four hours after dressing changes, and from the data-collection dressing change to the next dressing change was evaluated. No significant difference between amount of medication administration, for NPW versus PPW, existed ($p < .05$).

Opioid Pain Medication Administration

Amount of opioid medications. The finding that there was no significant difference in the amount of opioid pain medication administered to subjects carries an implication that PPW, and not differential medication administration, was responsible for

differences in pain scores. A greater amount of opioid medication given for PPW would imply that decrease in pain scores was due to administered analgesics, which is not the case.

Nor did PPW significantly decrease subjects' need for analgesic medication. However, in some patients, slightly less medication was given for PPW. These findings could be related to decreased pain or to other factors. In addition, the average interval between initial opioid administration and subsequent IV opioid administration was somewhat greater for PPW than for NPW. The reason for this finding could relate to verbal and behavioral cues that nurses were accustomed to following under the usual conditions of NPW. The stimulus for the nurse to administer incremental amounts of medication, once the dressing change was in progress, was the display of pain. Subjects performing PPW did not scream, did not verbalize repeated pain scores of 10, and did not ask for respite. Consequently, the accustomed impetus for administration of additional medication was lacking.

The amount of medication given at the beginning of the PPW dressing change was based on the amount given the day before during NPW; it may be that patients could possibly have tolerated dressing changes with less medication on PPW days. This opinion is completely hypothetical and has not been tested.

Amount of pain relieved. In the doses administered for dressing changes, opioid medication took away some of the pain but did not take away all of the pain on all of the data-collection days for any of the subjects. It is not known whether administration of

enough opioid to take away all of the pain for burn victims is a viable option. Watkins (1993) has described the intraprocedural administration of 23 mg. of morphine sulfate to a 35-kilogram pediatric patient for tubbing and debridement, with removal of all pain and without respiratory embarrassment. In contrast, the ten 60-to-100 kilogram adult subjects in this study received between 2 and 36 morphine equivalents for dressing changes, some of which were preceded within 30 to 120 minutes by two tablets of oxycodone with acetaminophen, or hydrocodone with acetaminophen. The maximum amount of medication administered before and with the dressing change was 46 morphine equivalents in an extended tubbing and debridement for a subject weighing 83 kg. It is not known whether administration of additional opioids to subjects would have eliminated all pain.

Washing Adequacy

Quantitative assessment. Quantitative assessment of washing adequacy was made by blind raters at the end of the washing portion of the dressing change. There was no significant difference in Likert ratings of adequacy of washing when NPW days and PPW days were compared. This finding is opposite to Tarnowski et al.'s (1987) findings, in which the physical therapist responsible for and present for tubbing rated both the therapist's own quality of washing and debridement and the subject's quality of washing and debridement.

There are two possible explanations for the difference in results. The first explanation is that use of a rater who is not blind to

whether washing and debridement is performed by therapist/tubroom nurse or subject cannot evaluate the subject as having performed a totally adequate job without subjective loss of rationale for causing pain to patients during the dressing change (i.e., if the subject is doing as good a job, how do I justify doing the same job and yet causing the subject more pain?).

The second explanation is that the single subject in Tarnowski et al.'s (1987) study was in fact performing self-washing and debridement inadequately and the ten subjects in this study performed washing and debridement adequately, by virtue of chance or by virtue of their status as adults, as opposed to Tarnowski et al.'s (1987) subject's status as a child.

The first explanation is more likely to be legitimate. However, this is open to question.

Qualitative assessment. Qualitatively, several subjects reported that the nurses were more thorough and more vigorous than the subjects themselves could have been. Three interpretations are possible. The first is that the subjects indeed were less vigorous than the nurses were in washing and removal of eschar and nonviable tissue. Observation of subjects yielded the qualitative impression that four subjects were less vigorous than the nurses, four were equal in vigor, and two were more vigorous than the nurses in self-washing and debridement. Consequently, the interpretation that patients did not wash and self-debride as vigorously as did the nurses is not a valid one for the sample taken as a whole but may be valid for certain individual subjects.

A second interpretation is that subjects accomplished the same end, causing themselves less pain (because of different touch and different technique, coupled with decreased apprehension) and consequently interpreted the decrease in pain as evidence of inadequate debridement. This interpretation is supported by subjects' significantly decreased pain scores on PPW days and by comments that they found NPW more painful in all cases, even though more than half of the subjects appeared to be washing and debriding as vigorously as, or more vigorously than, were the nurses.

A third interpretation is that nurses are more vigorous in washing, and consequently in causing pain, but that their technique does not produce a measurable advantage in wound cleansing, as compared with subjects' level of vigor. This interpretation is provocative and important to test: are burn nurses too aggressive in performing wound care?

Vigorous debridement and gender. The three subjects who debrided themselves more forcibly than did the nurses or who washed themselves until they bled were all men. Their HLC scores were the three most internal of the ten subjects. It seemed that in their actions there was an element of proving their toughness. They were all seen to assess the tubroom nurses' reactions to their efforts and to expect, and receive, acknowledgment of their ability to withstand pain and to produce a completely washed burn. Tubroom nurses on these days of data collection were all women. It is possible that the humiliation and loss of self-respect that one subject verbalized were related to being a man and displaying pain in front

of women. The show of bravery observed in all three subjects may have been based on a need to "be a man" and to act in what they considered was a brave, manlike, stoic way. This behavior has not previously been described in burn patients.

Health Locus of Control and Mood State

Health locus of control. Health locus of control (HLC) scores, in which a low number indicates an internal locus and a higher number indicates an external locus, were moderately negatively correlated with Likert rating of PPW preference. This finding implies that subjects who had a more internal locus of control, and were more likely to take the initiative regarding health matters, were more positive in their attitude toward PPW, which is logical. It may be that determination of HLC can predict which subjects would be most likely to prefer PPW.

Mood state. The moderate negative correlation ($p < .05$; $r_s = -.5922$) between the vigor-activity subscale of the short-form POMS and Likert-rated preference for PPW is paralleled by subjects' observations concerning how much effort PPW required and by Subject 2's and Subject 5's requests for NPW on days on which they were exhausted. Administration of the short-form POMS followed at least two episodes of PPW. It is possible that subjects who preferred PPW, and therefore were vigorous in self-washing and self-debridement, consequently felt more tired than, and less vigorous than, subjects who preferred NPW, who may not have been as physically enthusiastic performing PPW. The reverse assumption, that subjects with initially lower vigor and activity preferred PPW

because of their lack of vigor, is contradicted by subjects' comments describing PPW as work. Both views are supported by the nonsignificant weak positive correlation ($p < .10$; $r_s = .4940$) between the vigor-activity subscale and Likert-rated preference of NPW.

The Nature Of Procedural Burn Pain

Subjects' interviews, comments and behaviors relative to procedural burn pain provided a description of previously undescribed concepts that punctuated the experience.

The Physical Contribution

The contribution of technique of washing to pain is previously undescribed. It is reasonable that procedural burn pain differs with variation in pressure and frequency of nociceptive firing. However, different subjects' preferences for different techniques is interesting. Preferences for firmness of touch, speed of washing and pattern of washing, and individual tolerance of additive pain, varied from subject to subject. Pain is such a subjective experience that failure to consider individual patient preference for techniques of washing is not reasonable.

Central Control

Systemic medications. Medications have long been used for burn pain, and their effectiveness in taking away some, not all, of procedural burn pain reflects Fagerhaugh's (1974) report of the burn dressing change as an extremely negative experience. Proponents of large dosages of opioids may note that pain-free NPW dressing changes did not exist and may comment that all ten subjects were undermedicated. Opponents of large dosages of opioids may note

that pain-free NPW dressing changes did not exist within the range of 2 through 46 morphine-equivalents and may not exist short of the unconsciousness that accompanies extinguishing of the respiratory drive. This study's focus is not the value of opioids in burn dressing changes, but it is interesting to note that, despite a wide variation in administration of opioids, pain existed for all NPW dressing changes.

Previous anxiety, apprehension, vigilance and experiences. No subject interview comments directly supported the contribution of preexistent anxiety, tension, depression or past experience upon pain. There did not seem to be any consistent relationship between mean pain intensity and either behaviors of anxiety or score on the tension-anxiety subscale of the POMS. This finding is in opposition to Choiniere et al.'s (1989) finding that anxiety was correlated with procedural pain intensity. Subjects 1, 2, 4, 6, 9 and 10, who had the highest mean pain scores, were observed to have differing appearances of apprehension before dressing changes and did not necessarily rate higher than other subjects on the tension-anxiety subscale of the POMS. Although Subjects 1, 2, and 6 all appeared relaxed and were socially pleasant and able to maintain casual conversations before their dressing changes began, their POMS scores were dissimilar, with Subject 6 rating high both in the total and in the tension-anxiety subscale and Subjects 1 and 2 rating lower in both the overall and the T-A subscale. Subject 9, who seemed somewhat worried at times before his dressing change and verbalized dreading the procedure, rated high in the total POMS score but not unusually high in the tension-anxiety subscale. Subject

10 verbalized disliking the dressing change but did not seem anxious or agitated related to its imminence. His POMS scores were unremarkable in total and in T-A subscale scores. Subject 4 verbally expressed her dread of the dressing change when she was told when it would be occurring in the morning and appeared terrified before each procedure; her total POMS score was somewhat elevated, but her T-A subscale score was not.

The Gate Control Mechanism

Zero pain. The existence of pain-free intervals, after premedication and preceding the dressing change activities, may parallel Perry et al.'s (1981) periods of pain ranging from none to moderate: one wonders if Perry et al.'s (1981) subjects were referring to periods immediately before or somewhat following the dressing change, when medications had been administered, when they reported pain-free intervals.

However, the existence of pain-free intervals during PPW has not previously been described in burn patients. It is of note that pain-free intervals occurred during PPW but never during NPW.

Fluctuation of pain during the dressing change. The fluctuation of pain during the burn dressing change has not previously been described in children or adults. It is reasonable that burn pain fluctuates as peripheral nociceptors are differentially stimulated, as medications are administered and as descending inhibitory control provides endorphins in greater or lesser measure. It is predictable that pain with NPW fluctuates as nurses pause in their washing efforts to select a different debridement instrument or to turn their

attention to a different burned area. Pain with PPW should also fluctuate, as patients concentrate on different areas or pause for a moment of rest.

The pain intensity score of 10. Pain intensity scores of 10 with their attendant verbalizations and behaviors are previously undescribed in burn literature. However, the agony of burns and the vocalizations of burn patients have been described (Beales, 1983; Fagerhaugh, 1974). The absence of verbalizations of intensity during PPW is a new finding.

Descending Inhibitory Control

The physical milieu, predictability and fears. The importance of the physical milieu in adults' procedural burn pain is previously undescribed. However, Blew et al. (1989) described the use in outpatients of self-distraction for baseline burn pain by means of reading, radio and television. The importance of predictability in burn pain has been described in children by Shorkey and Taylor (1973) and by Kavanagh (1983b) but never in burned adults. Shorkey and Taylor (1973) described the importance of the milieu in the context of establishing predictability, and Beales (1983) described the contribution of the sight of the debridement instruments in creating apprehension and preventing effective distraction in children.

Fears of adult burn patients during dressing changes have not previously been addressed. Fear of pain during NPW predominated, similar to Beales's (1983) findings with children. During PPW, fear of pain was reported by only one subject. One subject, near homegoing,

reported that during PPW he had to look at his burns and consequently feared what other people would think of his scars.

Powerlessness. Feelings of powerlessness were described relative to his burn injury by one subject, and relative to nurses not altering or abating dressing change washing techniques in response to their requests by three other subjects. Powerlessness in burned children was addressed by Kavanagh (1983b, 1991) but has not yet been described in burned adults.

The personal touch. The importance of the personal touch in procedural burn care has not been described. It is interesting that maintenance of respect for the subject's humanness appears to affect pain. Subjects remarked that some nurses did not cause them as much pain as did others. Although differing amounts of pain are likely to have been due to a different physical style of washing, to subjects' amount of sleep the night before, to different worries, or to myriad other factors, it is possible that interpersonal style also accounted for some of the nurse-to-nurse difference subjects reported. It may be that, because of some intangible interpersonal magic, certain talented and compassionate nurses should be encouraged to perform dressing changes whenever possible. There is no research that currently investigates burn nurses' charisma and comforting behaviors.

Peripheral Input Versus Descending Inhibitory Control

It may be that a patient's belief that a certain technique is more painful is legitimate; in this case, decreasing nociceptive input results in decreased pain intensity. However, even if the patient's

belief is erroneous, the patient's experience can be that of decreased pain, because of the decreased apprehension and heightened control the patient experiences; in this case, descending inhibitory control modulates pain's intensity.

The Primary Appraisal

NPW as challenge, threat or harm-loss. NPW was viewed by subjects as challenge, threat or harm-loss, depending upon their own personalities, experiences and ways of viewing pain. Subject 3 voiced feeling that he did not feel competent performing PPW. He submitted stoically to NPW, treating it as a challenge. Subject 5 reacted to most of her NPWs as challenge, because "I had to endure it." Subject 6 reacted to NPW at first as challenge and then as threat, especially after being introduced to PPW. Subject 4, who reacted most negatively to NPW, with multiple verbalizations and prayers, clearly saw NPW as harm-loss. Pain had similar descriptors and pain scores for all these subjects; their pain intensity scores all reached 10 on some occasions. However, their appraisals of NPW differed in response to the meaning the experience held for them.

PPW as challenge or threat. For most subjects, PPW had elements more of challenge than threat. Harm-loss was not observed. Subjects became interested in performing their dressing changes and asked intelligent questions of the nurses related to their technique and to the expectations nurses had of them. During PPW, subjects were very focused on the areas they were washing. Erikson (1963) described industry versus inferiority as the crisis of the schoolage child. Subjects looked like industrious, learning 10-year-

olds as they focused upon and attended to the task at hand. Threat existed for Subject 1 at the very beginning of PPW when he feared hurting himself, and Subject 3 would have experienced threat if he had been expected to wash his wounds routinely, because of his expectation that the nurses' performance was superior to his.

The Secondary Appraisal

Problem-focused strategies. The problem-focused strategies are action, inhibition of action and information-seeking. Subjects selected different strategies for NPW and PPW.

Actions selected during NPW were limited to pulling away from the nurse and talking the nurse through the dressing change. During PPW, subjects employed a variety of actions, related to washing. The more experience that subjects had in PPW, the lower were their Likert scorings of NPW preference. This effect upon preference may reflect subjects' increased self-efficacy with successful performance. Bandura's (1977) self-efficacy theory, based on experiences with phobic subjects as they mastered their fears through practice, can be applied to the tendency toward increased comfort seen with PPW over time. It must be noted that during PPW nurses were active in their supervision of PPW and in their intermittent acknowledgment of the adequacy of washing efforts by subjects. It is not known whether increasing or decreasing this reinforcement by nurses would affect patients' task-mastery and preference for PPW.

Inhibition of action as a problem-focused strategy was seen during NPW and PPW. During NPW, inhibition of action was related to not pulling away from the washing cloth. Endurance was the goal

for NPW subjects. For PPW, one subject used inhibition of action to try to look as if he was doing a thorough job but to avoid washing as vigorously as he knew the nurses had washed.

Information-seeking was different for NPW and for PPW. For NPW, subjects' information-seeking was related to the timing and duration of the experience, to the areas of anticipated pain and to the amount of medication given. For PPW, subjects requested specifics related to task-mastery and requested confirmation of their washing efforts.

Emotion-focused strategies. During NPW subjects used the emotion-focused strategies of rationalization and intellectualization to justify the washing experience as necessary and beneficial. No exclusively emotion-focused strategies were reported or observed for PPW, possibly because subjects were utilizing problem-focused strategies that were affecting the problem of pain. However, the decision to participate in PPW may, in itself, represent both a problem-focused and an emotion-focused strategy.

Key Concepts Related to Dressing Change Washing

Exhaustion. The concept of exhaustion pervaded the dressing change experience, and several subjects found the vigor-activity subscale items of the POMS humorous, stating that they had seldom felt less vigorous. It appears that subjects became so physically exhausted that maintenance of a lowered arousal state was almost inevitable. Subject 2's report that after a sleepless night he preferred NPW may reflect his inability to have maintained even the moderate levels of arousal necessary to concentrate and perform

proficiently during PPW. Subject 5's report that when her face was almost healed she preferred NPW (because it was like having her hair done) is reminiscent of Corah's (1973) observation that for lower-intensity aspects of pedodontic procedures, not having control of the experience further lowered arousal.

Time. Time as a variable during the dressing change procedure was important to subjects. Patients, in general, were critical of nurses who rushed through the dressing change, despite patients' requests to slow down, to provide more breaks, or to wash more slowly. The subjects' perception of nurses rushing through the dressing change may be related to the concept of exhaustion but are as likely to be related to the frequency of nociceptive impulses, because increasing the frequency of nociceptive impulse transmission results in perception of increased pain intensity. Nurses were physically able to perform the task of the dressing change quickly because of their enormous experience in washing and redressing wounds, whereas the subjects were still refining their dressing change techniques and required more time.

The burn census during the period of data collection varied between 4 and 15 burn patients, most of whom required dressing changes on day shift. Although nurses did not verbalize it to subjects, nursing staff's agenda on busy days was to complete dressing changes within 30 to 60 minutes, depending on the extent of the subjects' burns and also depending on how many nurses were available to perform dressing changes. Consequently, in times of high patient census and tight staffing, nurses worked briskly,

sometimes doubling up for dressing changes, performing a dressing change with one nurse and a student nurse extern in a little more than half the time it would take one nurse to finish. Washing during NPW with a lone nurse was often brisk, as well. Nurses would say, "Let's get this over with," or "Let's get you out of here." For subjects who preferred to "bite the bullet" and experience a large amount of pain in a short time, this pressured schedule was perfect. For subjects who preferred to endure less pain over a longer time during NPW, the realities of "processing" the patients worked counter to subjects' preferences. For aware, motivated subjects, such as Subject 2, it was possible for nurses to premedicate him, put him in the Hubbard tank, and let him self-debride with scissors used as a scraper at his own pace while the nurses performed another patient's brief dressing change in a separate curtained-off part of the tubroom. Thus, Subject 2 received enough time for careful self-debridement.

There was an expectation that subjects would complete their self-washing during a limited time, however. In general, during PPW nurses functioned as active coaches, lending instruction, advice and critique, which also maintained a faster PPW pace than would have occurred if subjects had been left to their own devices.

Endurance. The problem-focused strategy of inhibition of action was employed by subjects as they suppressed their inclination to pull away and submitted to NPW. As Subject 5 said, "it had to be endured." Endurance, which Webster's defines as "the ability to last, stand pain, etc.," literally means to become hard. This voluntary self-

hardening, or toughening, to pain seemed to be a decision patients made. A suggestion of moral fiber and determination pervades this concept. It is interesting to note that at times of maximal endurance to the pain of NPW, subjects were observed to tense their muscles, to become physically harder, providing a physical pun. This physical tension, sometimes leading to quivering or tremoring, is an unconscious physiological response to pain that causes large-fiber afferent activity, thereby modulating pain's intensity.

Unwillingness to reverse back from PPW to NPW. Subject 6's resistance to being passive, once he had been introduced to PPW, epitomized what Kavanagh (1983b) described in children who were allowed to participate in their own dressing changes: once the children had the opportunity to participate, there was a desire to remain involved. Subject 6 embodied this desire to remain involved most strongly. However, it was noted that Subjects 5, 7 and 10 also maximized their physical or verbal control during PPW and NPW after having been introduced to PPW.

Conclusions

Most burn subjects appear to experience less pain with PPW, prefer PPW to NPW and describe PPW in different terms than NPW, and they would recommend that a burned friend try PPW. All burn subjects, when adequately supervised and coached, seem to wash as adequately as do burn nurses and use about the same amount of medication for PPW as for NPW. A minority of subjects does not prefer PPW. In comparison with the group preferring PPW, the subjects preferring NPW tend to have had less experience with PPW,

to have described their pain during PPW high on the evaluative subscale of the MPQ and to have scored more externally in locus of control than other subjects on the HLC.

In relation to hypotheses tested, it appears that PPW and NPW produce significantly different pain intensity scores within all subjects, with pain intensity lower for PPW than for NPW. There appears to be no significant difference in medication administered when PPW and NPW are compared. If burn patients demonstrate significantly lower pain scores with PPW, they do not necessarily prefer PPW to NPW.

Serendipitous Findings

A serendipitous outcome of this research was the discovery that subjects were willing, even eager, to talk about their pain to someone who was interested. In the course of the final interviews, many issues not related to pain emerged. Subject 5 confided the harrowing particulars of her accident. Subject 7 confided his fears relative to his burn scars and his appearance. In both instances the researcher allowed time for subjects to talk and, in one case, to cry.

The circumstances of patients' burn injuries are expected to cause a degree of post-traumatic stress disorder. However, the dressing change itself appears to produce enormous stress for other patients. Subject 4, for instance, named NPW, not her burn injury, as the worst experience of her entire life. Interviews that take place near homegoing can identify subjects' primary traumata and, more important, identify the need for subsequent counseling during the outpatient period.

A second serendipitous finding was the day shift nurses' willingness to defer to the researcher in questions of pain medication history. Nurses frequently asked the researcher how much total medication the subject had received on the previous day, or which medications had been used. The research data were all available, "at hand," so the researcher could provide immediate information, preventing pauses during which the information had to be obtained from the bedside chart, and preventing guessing.

A third serendipitous finding, unrelated to burn wound washing was that at the end of the dressing change, putting elastic nets over the dressings to hold them in place was much more painful than previously recognized, if the nets were applied by a sole nurse. The reason for the increase in pain was the nets' tendency to flatten and slide along the burned extremity. A second person helping stretch the nets outward made application much less painful. By the end of data collection, application of nets on day shift was most frequently a two-person endeavor.

Limitations

The small sample size of ten and the single site of the research make generalizability to other burn inpatients limited. The lack of parallel studies using the same population makes comparisons with other adult subjects impossible; comparisons have been made to pediatric research studies using the same intervention whenever possible.

Subjects were interviewed while still patients in the hospital. Thus, subjects' total retrospective view of the experience is lacking.

Follow-up interviews after a period of six to twelve months could be revealing.

Future Research

In order to test the findings of this study, to expand the findings to pediatric populations, and to test different aspects of control for the burn patient, the following recommendations are made:

1) Replicate the study with populations from multiple sites.

2) Expand the research to the pediatric population, using the same research design, and using pain scales instead of the observed behaviors frequently used in pediatric burn pain research.

3) Investigate the use of verbal control, in the form of time-outs and nurse adherence to patient preference in technique, for burned adults as well as children.

4) Investigate the use of patient-controlled analgesia (PCA) machines for administering medications during the dressing change.

In relation to the abundance of pain intensity scores of nine and above under NPW conditions, an additional recommendation is made:

5) Investigate the efficacy and safety of administration of liberalized amounts of opioids, and of opioids with anxiolytics, for nurse-performed washing during dressing changes.

Implications for Practice

Within the area of implications for practice, it is important to reiterate that all burn subjects have their own ideas and opinions, and certainly their own perceptions of pain intensity and of

potentially effective strategies for pain modification. In most instances, burn patients can provide information about what they like and do not like, relative to dressing change technique. Even if research information supports a certain style of dressing change or a certain method of washing for most burn patients, there will always be the exception, the patient who does not conform to expectations. The patient's perception of whether a certain strategy is more or less painful becomes that patient's reality, because pain is, finally, a perception. The best intervention for diminishing pain is, to draw a parallel with McCaffrey, whatever the patient says it is.

Several recommendations emerge from the study. The first and foremost is the recommendation that PPW as implemented in this study be trialed in other burn centers. There is evidence that PPW is no worse than NPW in cleansing burn wounds and far superior to NPW in terms of preventing suffering. If patients self-wash, they can avoid the frequent pain spikes of NPW, and they can also experience the feeling of being in control of their pain experience. Nurses are not removed from the process but act as coaches instead. Some patients will not be able to self-inflict pain in the amounts necessary to accomplish debridement; nurses can then finish the dressing change, debriding areas less than adequately completed. Other patients may express a clear preference for NPW, in some or all body areas, due to increased pain, exhaustion or other factors when they attempt PPW; nurses can perform dressing changes when, and for whatever areas, patients choose not to perform PPW. The choice should be the patient's.

The second recommendation is that patients be socialized into the process of self-washing early in their hospitalization before they have been accustomed to severe debridement pain, and that patients be urged to continue to self-wash on at least three occasions, in order to establish mastery.

The third recommendation is that nurses maintain an active role coaching and criticizing PPW, not only for reasons of interpersonal support but for the practical purpose of maintaining a reasonable pace during the dressing change in order to meet unit time constraints.

The fourth recommendation is that, for patients who are unable to wash some or all of their wounds, the patient's preference as to washing pressure, washing speed, washing direction and order of areas to be washed be elicited and followed. At the beginning of hospitalization, when the patient is unexperienced, or for the nonverbal patient, using the most commonly-voiced preferences (i.e., a delicate touch on fingers, longer strokes on the torso, a wet washing cloth, washing with the direction of hair growth) is recommended.

The fifth recommendation is that, for all burn patients, nurses talk to them instead of about them; tell them in advance what will be done; warn the patient what burned areas will be touched and in what direction the washing will proceed; warn the patient when something will be especially painful; tell the patient when washing is completed; coach the patient in behavioral or cognitive strategies for enduring pain, such as breathing exercises; and acknowledge the

enormous expenditure of courage and endurance that even the screaming patient has brought forth.

The sixth recommendation is that nurses medicate according to patient request and patient need as soon as possible when pain is identified during the dressing change. Premedication before the dressing change is necessary, as well, along with sufficient time for the medication to become effective. Early during the hospitalization the patient needs to be informed what medications are available and how and when to request them. Some patients need to be reminded during the dressing change that they are in pain and that they can have more medication. More than half of the recorded pain scores during NPW were between nine and ten; this, in itself, is an indication that, from the standpoint of pain relief, more medication could be administered.

The seventh recommendation is that all patients be interviewed about their pain by a nurse, psychologist, psychiatrist, anesthesiologist or other health care professional with experience related to pain and pain relief. There can be enormous benefit in telling one's story to a person who listens, particularly after an especially traumatic injury. The telling of pain is not limited to physical pain. Almost all burn patients have suffered life pain as well as physical pain; the burn patient with a moderate injury who has had a staggering personal loss and complains of enormous and unrelenting pain may be speaking of pain as a metaphor for life pain. From loss of income to loss of personal appearance to loss of property to loss of the life of a family member, all loss is important and

crushing to the patient, all loss is important. The telling of the loss is necessary and therapeutic. The circumstances of a significant burn injury represent physical trauma in its worst incarnation; a burn is unexpected, destructive, painful, swift, terrifying, undeserved. The story of the burn and its results needs telling, perhaps over and over, so that it may become first real, later manageable, and finally a piece of the patient's personal history.

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Appendix A

Tables 1 Through 11

Table 1
Procedural Small-Fiber Nociceptor Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Cruse and Daniels (1989)	Descriptive	N = 20, 0.5-6% TBSA, most partial-thickness	Trial of elastic, flexible nylon adhesive sheet, impregnated with 1% silver sulfadiazine (SSD) and containing some DMSO; dressing changes every 4-5 days	Good wound healing resulted. Blood levels negative for DMSO. No sepsis. One of the 20 subjects later required grafting for a full-thickness area.
Gerding et al. (1988)	Prospective randomized clinical trial	N = 43 subjects with 50 wounds	Wounds randomly assigned to Biobrane or 1% SSD cream group; SSD changes BID; Biobrane changes as needed	Faster healing, less pain, less expense with Biobrane. Biobrane failure rate 26%. Infection rates equal.

Table 1 (continued)
Procedural Small-Fiber Nociceptor Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Guilbaud (1992)	Prospective randomized clinical trial	N = 62, 6-72 years, multisite, multinational	In subjects with 2 similar burns, local customary treatment used for one wound, Inerpan (a synthetic adherent skin substitute) for the other.	Inerpan wounds displayed shorter mean healing time, better quality healing, less pain for dressing changes and fewer dressing changes
Han and Maitra (1989)	Prospective randomized clinical trial	N = 213, 0-75 years, less than 10% TBSA (75% of the sample less than 1%)	Inadine, a rayon dressing with povidone ointment and Bactigras, a tulle gras dressing with 0.5% chlorhexidine, were compared.	No significant difference in pain. Inadine group displayed less bleeding.

Table 1 (continued)
Procedural Small-Fiber Nociceptor Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Miller et al. (1990a)	Descriptive	N = 59, 9-65 years, TBSA less than or equal to 40%	Sildimac, an elastic flexible sheet, moistened with antibiotic solution	Dressing changes performed only every 4 days, instead of once to twice daily. Patients rated removal significantly less painful than with standard dressings.
Miller et al. (1990b)	5-group comparison	N = 29, 15 to 56 years, TBSA less than 30%	Chlorhexidine diphosphanilate, in 4 different concentrations, reported to be painful, compared with 1% SSD	2% concentration more painful ($p < .05$). 1% concentration not significantly more painful but almost so. 0.5% concentration more painful but not statistically significantly. No difference in pain between 0.25% concentration and 1% SSD.

Table 1 (continued)
Procedural Small-Fiber Nociceptor Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Phillips et al. (1989)	Descriptive	N = 851, with shallow burns (expected to heal within 2 weeks)	Biobrane, a biosynthetic dressing, like textured plastic wrap	If Biobrane adheres and does not infect, no dressing changes are needed. If Biobrane infects, it must be removed. Infection rate 2.8-7.5%, by location.
Sawada et al. (1990)	Quasi-experimental	N = 27, each burn divided in half, with gel sheet applied to one half, and standard topical to the other	Anti-microbial releasing silicone gel	Dressing changes not needed under gel sheet, but sheet lifted and burn washed and debrided if necrotic tissue needed to be removed. Significantly less time until healing.
Sawhney (1989)	Descriptive	N = 90, with 3 groups of 30 subjects each, having superficial, intermediate and deep burns	Amniotic membrane compared with 1% SSD cream	Burns treated with amniotic membrane healed faster, exhibited better healing and were reported to be painless, at level of $p < .01$.

Table 1 (continued)
Procedural Small-Fiber Nociceptor Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Sinha and Swaroop (1988)	Descriptive	N = 73, 3-57 years, 53 with superficial burns, 20 with deep burns	Povidone used both alone and with neosporin powder layered to make a crust; no dressing changes for 3 days; deep burns also injected subcutaneously (S-Q) with iodine	Infection rate for burns lower than with standard treatment. Less pain, due to fewer dressing changes.
Subrah-manyam (1991)	Prospective randomized clinical trial	N = 104, 82 male, 22 female, 1-65 years, 1-40% TBSA	Honey used as topical, compared with 1% SSD-impregnated gauze pieces; daily dressing changes	Honey group healed faster and demonstrated less infection. Investigators' subjective opinion was that the honey group seemed to suffer less pain.

Table 1 (continued)
Procedural Small-Fiber Nociceptor Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Terrill et al. (1991)	Descriptive	N = 14 subjects with 20 hand burns, mean age 34-36 years	Use of GORE-TEX bags for hand burns, as opposed to polythene	Less maceration with GORE-TEX bags. Less pain, but not statistically significantly.
Yang (1990)	Descriptive	N = 62 subjects with 76 wounds; 17 post-excision wounds excluded from study	Young Collagen Wettable Membrane (YCWM), made from pig collagen, trialed	YCWM does not work well in deep wounds following surgical excision of eschar. YCWM works as well as Biobrane for donors and superficial burns. YCWM is less expensive than Biobrane.

Table 2
Procedural Peripheral Large-Fiber Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Jichova et al. (1983)	Descriptive	N unspecified, TBSA up to 30%, partial-thickness	Acupuncture used for burn pain; repeated every day or two; also used preoperatively and before the dressing change	The sensations of burning and pain were eliminated within 25 to 30 minutes of acupuncture. Use in conjunction with the dressing change reduced need for analgesia by half.

Table 3
Procedural Systemic Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Osgood and Szyfelbein (1990)	Descriptive	Two 15-year-old young men with 20% and 58% TBSA	IV fentanyl compared with oxycodone	Pain scores lower when treated with fentanyl than with oxycodone.
Lee (1987)	Double-blind randomized trial	N = 50, adults, mean burn 9.42 to 15.57% TBSA	IV nalbuphine compared with morphine	No significant difference between groups.
Lee et al. (1989)	Double-blind randomized trial	N = 50, adults, mean burn 9.4 - 15.6% TBSA	IV nalbuphine compared with with morphine, both in conjunction with nitrous oxide	No significant difference between groups.
Filkins et al. (1981)	Retro-spective descriptive chart review	N = 52, 16-64 years, male, 2 to 85% TBSA	Self-administered nitrous oxide, 50-50 mixture	All but one patient experienced pain relief.

Table 3 (continued)
Procedural Systemic Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Rice and Kyff (1990)	Case study	N = 1, 4 years old, 80% TBSA	Three mg. of midazolam dripped into child's nose to produce sedation for deep line insertion in an agitated burned child	Within 5 minutes child sedated and cooperative; central line inserted without difficulty.
Demling et al. (1978)	Retro-spective descriptive review	N = 45, 18 months to 71 years, 20-75% TBSA	IM ketamine for knife excision in burn unit	Effective anesthesia for excision. Safe. No flashbacks or psychological problems.
Groene-veld and Inkson (1992)	Descriptive chart review	N = 16, 20 months to 8 years, 1-48% TBSA, 25 dressing changes	Ketamine, usually intramuscularly (IM), given for procedures.	One child had an unpleasant experience related to nausea. The other 15 children experienced dreams and hallucinations but reported no distress in relation to these.

Table 3 (continued)
Procedural Systemic Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Martinez et al. (1985)	Descriptive, interview plus questionnaire 72 hours after ketamine	N = 15, 20-58 years	Ketamine anesthesia for debridement	Ketamine described as frightening by 40% of patients. 53% of patients felt helpless.
Ward and Diamond (1976)	Descriptive	N = 16, 6 children, 9 months to 8 years, and 10 adults, 24-74 years	Ketamine use for dressing changes	One adult reported an unpleasant induction, another an unpleasant recovery. One child suffered aspiration. No adult would refuse if available again.

Table 4
Procedural Cognitive Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Kelley et al. (1984)	Single subject reversal	N = 2, 4-year-old, 6-year-old, 29-35% TBSA	Cartoon-viewing and reinforcer of star chart for less crying that on previous day	Manifestation of pain positively correlated with amount of cartoon-viewing. Questionable application to pain itself.
Miller et al. (1992)	Prospective randomized clinical trial	N = 17, 16 male, 1 female, mean TBSA 19.9% in treatment group, 23.5% in controls, adults, 165 dressing changes	Viewing of films of scenic beauty during burn dressing changes for experimental group	Pain intensity and anxiety did not differ between groups before dressing changes but were significantly lower during and after dressing changes in the experimental group.
Savedra (1976)	Descriptive	N = 5, 6-9.5 years, 30-65% TBSA	Spontaneously generated strategies in and around dressing changes	Reduction of threat (trying to diminish forcefulness of nurses' washing technique) and attempts to postpone were most common strategies.

Table 4 (continued)
Procedural Cognitive Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Wernick et al. (1981)	Prospective randomized clinical trial	N = 16, 8 experimental and 8 control, at least 15% TBSA	Stress inoculation: taught relaxation strategies and coached for dressing changes	Better subject- and staff-rated tanking behaviors than for controls. Possible Hawthorne effect - no equal time for controls.
Elliott and Olson (1983)	Multiple staggered baseline and reversal	N = 4, 5-12 years, 5-68% TBSA	Stress-management: patient taught strategies and coached in dressing change some days	Behavioral distress decreased only on days psychologist was in tubroom.

Table 5
Procedural Cognitive-Peripheral Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Kavanagh (1983a)	Case reports	N = 7; 7 to 30% TBSA; intervention for 5, none for other 2	Patient participation in dressing changes	Group that participated tolerated dressing changes better, showed decreasing anxiety and distress over time, less GI upset, no rage.
Kavanagh (1983b)	Quasi-experimental; nonconcurrent controls	N - 8, 2 to 12 years, 12-85%	Patient-controlled debridement and dressing change as far as possible, and visual cueing	Experimental group showed fewer maladaptive behaviors related to Children's Behavioral Inventory, calorie counts, hours of sleep, depression, and other measures.
Kavanagh et al. (1991)	Prospective randomized clinical trial	N = 32, at two sites; 2 to 58% TBSA; aged 16 months to 16 years	Patient participation in dressing changes, as far as possible	Serum cortisol and beta-endorphins higher in controls; in dressing change behavior, experimental group showed less distress.

Table 5 (continued)
Procedural Cognitive-Peripheral Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Tarnowski et al. (1987)	Within-subjects repeated reversal	N = 1, 12 years of age, with 25% TBSA	Self-mediated debridement (SMD) versus therapist-mediated debridement (TMD), alternating days	Mean pain, as evaluated by Procedure Behavior Rating Scale: 5.7 score with SMD, 63.0 score with TMD

Table 6
Post-Procedural Peripheral Small-Fiber Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Brofeldt et al. (1989)	Descriptive comparison, with patients as own controls	N = 30, TBSA 5-28%	5% lidocaine-bacitracin cream topically at dressing change	Lidocaine-bacitracin cream pain at 30 minutes after dressing change significantly less than 30 minutes before dressing change. Pain relief 2.7 times greater than with bacitracin alone.

Table 7
Post-Procedural Peripheral Large-Fiber Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Lewis et al. (1990)	Two-period crossover with initial randomization	N = 11, adults	Auricular TENS, placed at acupuncture sites on ear, within 15 to 75 minutes after dressing change	By ANOVA, treatment alone not significant, time highly significant, treatment times time significant. Authors claim statistically significant difference, but more likely a function of highly significant time factor.
Kimball et al. (1987)	Double-blind randomized clinical trial	N = 24, adults receiving Travase, an enzymatic debridement agent	TENS proximal to burn for experimental subjects, morphine for controls	No statistically significant difference between pain scores in TENS and morphine groups.

Table 8
Baseline Small-Fiber Nociceptor Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Jönsson et al. (1991)	Repeated reversal	N = 7, 4 female, 3 male, 10-30% TBSA, partial-thickness scalds	IV lignocaine bolus with IV infusion continued for pain greater than 50 on a 0-to-100 scale; 50-mg. boluses for dressing changes; standard treatment for reversal, then resumption of lignocaine and additional reversal	Significant pain relief with lignocaine for all 7 subjects, by the Wilcoxin Signed Ranks Test.

Table 9
Baseline Systemic Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Choiniere et al. (1992)	Double-blind randomized clinical trial	N = 24, 16-70 years, TBSA 2-41%	All subjects received both PCA and IV bolus medication for pain, one a placebo and one morphine	Subjects who received morphine by PCA experienced slightly less pain. Efficacy was judged by nurses to be significantly better in the PCA morphine group. The PCA morphine group used slightly greater amounts of morphine than did the IV bolus morphine group.
Cram and Kealey (1990)	Prospective randomized clinical trial	N not specified, adults	Experimental group received PCA morphine, controls IV bolus	PCA group experienced significantly less pain than the bolus group. PCA subjects used significantly more morphine than did controls.
Gaukroger et al. (1991)	Descriptive	N = 11, 4.75-14 years, 9-65% TBSA	PCA morphine used for baseline pain	92% of baseline pain scores mild pain or less; all subjects awake or slightly drowsy; nausea or vomiting present in only 5% of subjects

Table 9 (continued)
Baseline Systemic Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Kinsella et al. (1988)	Descriptive	N = 18 postoperative and 5 acute burn	PCA morphine	Amount of morphine used daily calculated; no other data reported.
Wermeling et al. (1986)	Case report	N = 1, with poor previous pain control on high-dose boluses	PCA morphine	Patient experienced pain control and no respiratory embarrassment with 13-mg. boluses and 6-minute lockout.
Concilus et al. (1989)	Descriptive	N = 17, adults, 29 to 71% TBSA, with previously poor pain control on morphine boluses	Continuous infusion methadone after 2 hours' loading dose	Pain relief positive for 70% at 2 hours, for 80% at 24 hours. One subject reversed with naloxone for pCO_2 = 55.
Denson et al. (1990)	Descriptive	N = 14, TBSA greater than 10%, 18-70 years	Continuous infusion methadone after 2-hour loading dose	Methadone levels only about half of recommended level for analgesia at 4 and 24 hours, despite 80% of patients' report of pain relief at 24 hours.

Table 9 (continued)
Baseline Systemic Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Alexander et al. (1992)	Quasi-experimental: subjects matched for age, TBSA and length of stay with morphine drip (MS gtt) patients	N = 10, 12-75 years, 5-60% TBSA	Stable MS gtt patients placed on MS Contin q 8-12 hours, with additional PRN escape doses	Dosages in morphine equivalents and pain intensity ratings not significantly different between groups.
Sandidge (1989)	Random assign-ment, crossover design	N = 9, male adults, TBSA 5-20%	Methadone pain cocktail, around the clock	Morphine equivalents equal within weeks; patients reported fewer negative experiences with methadone, less peak pain, better pain control overall.

Table 10
Baseline Cognitive Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Blew et al. (1989)	Question-naire	N = 44, adults, average TBSA 8%	Spontaneously generated strategies	Listening to TV, radio or stereo; sleeping; talking about pain and thinking about something else effective with average pain; no strategy effective with severe pain.
Knudson-Cooper (1981)	Quasi-experimental: subjects matched for age, gender and TBSA	N = 27, 7-16 years	Biofeedback, relaxation or no treatment	Relaxation and biofeedback both effective in reducing "anxiety" and "pain" but poor definition of pain as "feeling good."
Shorkey and Taylor (1973)	Case report	N = 1, a 17-month-old	Visual cueing	Global fear reversed completely in 72 hours.

Table 10 (continued)
Baseline Cognitive Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Tobiasen and Hiebert (1985)	Prospective randomized clinical trial	N = 20, 17-63 years, TBSA 10-50%	Psychological preparation in coping strategies versus equal time with the investigator	Increasingly able to handle the burn injury, less worry, less tiredness, greater capability and "feeling comfortable" for treatment group. Poorly defined terms for pain.

Table 11
Non-Burn Procedural Strategies

Authors Year	Design	Sample	Strategy	Pertinent Findings
Corah (1973)	Prospective randomized clinical trial	N = 24, 6-11 years, pedodontic patients	Signaling device: green light, meaning I-have-pain-but-continue, and red light, meaning I-have-pain: Time-out.	With use of signaling device, stress, as measured by galvanic skin response (GSR), lower during high-arousal procedures and higher during low-arousal procedures.

Appendix B

McGill Descriptors

What did your dressing change pain feel like?
Tell which words best describe your pain during your dressing change.
Use only a single word in each group - the one that applies best from that particular group. Indicate that word by circling it.
If there is no word in a certain group that describes your dressing change pain, do not choose a word

flickering	jumping	pricking	sharp
quivering	flashing	boring	cutting
pulsing	shooting	drilling	lacerating
throbbing		stabbing	
beating		lancinating	
pounding			
pinching	tugging	hot	tingling
pressing	pulling	burning	itchy
gnawing	wrenching	scalding	smarting
cramping		searing	stinging
crushing			
dull	tender	tiring	sickening
sore	taut	exhausting	suffocating
hurting	rasping		
aching	splitting		
heavy			
fearful	punishing	wretched	annoying
frightful	grueling	blinding	troublesome
terrifying	cruel		miserable
	vicious		intense
	killing		unbearable
spreading	tight	cool	nagging
radiating	numb	cold	nauseating
penetrating	drawing	freezing	agonizing
piercing	squeezing		dreadful
	tearing		torturing

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terrifying	cruel		miserable
	vicious		intense
	killing		unbearable
spreading	tight	cool	nagging
radiating	numb	cold	nauseating
penetrating	drawing	freezing	agonizing
piercing	squeezing		dreadful
	tearing		torturing

Appendix C

POMS (short-form)

Below is a list of words that describe feelings people have. Please read each one carefully. Then fill in ONE space under the answer to the right which best describes HOW YOU HAVE BEEN FEELING DURING YOUR BURN HOSPITALIZATION. The numbers refer to the following descriptive phrases:

0 = Not at all
1 = A little
2 = Moderately
3 = Quite a bit
4 = Extremely

	0	1	2	3	4
Tense	--	--	--	--	--
Angry	--	--	--	--	--
Worn-out	--	--	--	--	--
Unhappy	--	--	--	--	--
Lively	--	--	--	--	--

	0	1	2	3	4
Confused	--	--	--	--	--
Peeved	--	--	--	--	--
Sad	--	--	--	--	--
Active	--	--	--	--	--
On edge	--	--	--	--	--

	0	1	2	3	4
Grouchy	--	--	--	--	--
Blue	--	--	--	--	--
Energetic	--	--	--	--	--
Hopeless	--	--	--	--	--
Uneasy	--	--	--	--	--

0 = Not at all
1 = A little
2 = Moderately
3 = Quite a bit
4 = Extremely

	0	1	2	3	4
Restless	--	--	--	--	--
Unable to concentrate	--	--	--	--	--
Fatigued	--	--	--	--	--
Annoyed	--	--	--	--	--
Discouraged	--	--	--	--	--

	0	1	2	3	4
Resentful	--	--	--	--	--
Nervous	--	--	--	--	--
Miserable	--	--	--	--	--
Helpless	--	--	--	--	--
Worthless	--	--	--	--	--

	0	1	2	3	4
Cheerful	--	--	--	--	--
Bitter	--	--	--	--	--
Exhausted	--	--	--	--	--
Anxious	--	--	--	--	--
Weary	--	--	--	--	--

	0	1	2	3	4
Bewildered	--	--	--	--	--
Furious	--	--	--	--	--
Full of pep	--	--	--	--	--
Forgetful	--	--	--	--	--
Vigorous	--	--	--	--	--
Uncertain about things	--	--	--	--	--

Appendix D

Health Locus of Control Scale

Health and Illness

Below is a list of statements that are related to health and illness. Please read each one carefully. Then fill the space to the right of the answer with the number that represents one of the following statements:

0 = I strongly disagree with this statement.
1 = I disagree with this statement.
2 = I mildly disagree with this statement.
3 = I mildly agree with this statement.
4 = I agree with this statement.
5 = I strongly agree with this statement.

If I take care of myself, I can avoid illness. ____

Whenever I get sick it is because of something I've done or not done. ____

Good health is largely a matter of good fortune. ____

No matter what I do, if I am going to get sick I will get sick. ____

Most people do not realize the extent to which their illnesses are controlled by accidental happenings. ____

I can only do what my doctor tells me to do. ____

There are so many strange diseases around that you can never know how or when you might pick one up. ____

When I feel ill, I know it is because I have not been getting the proper exercise or eating right. ____

People who never get sick are just plain lucky. ____

People's ill health results from their own carelessness. ____

I am directly responsible for my health. ____

Appendix E

Interview Guide

You have had your burns washed by nurses during some of your dressing changes, and you have also washed your own burns on other days. Now that you are really an expert in what a burn patient's experiences of pain are, can you let me know what these experiences were like for you?

1. On the days the nurses washed your burns, what was the dressing change like for you?

Additional questions that may be used to elicit responses are:

What was the pain like?
Did the medication you were given take the pain away? About how much of the pain was taken away by the medication?
What made the pain better? What made it worse?
Were you afraid of anything? What were you afraid of?
Did you feel as if you were in control? Did you think that the nurses paid attention to your requests to alter the way they washed your burns or to stop for a moment so you could have a break?
What other feelings did you have on days the nurses washed your burns?
Did the dressing change seem to take a short time or a long time? What made it go slower or faster?
What was best about having the nurses wash your burns?
What was worst about having the nurses wash your burns?
Is there anything else about having the nurses wash your burns that is especially important for me to understand?
Would you like to add anything else?

2. On the days you washed your own burns, what was the dressing change like for you?

Additional questions that may be used to elicit responses are:

What was the pain like?
Did the medication you were given take the pain away? About how much of the pain was taken away by the medication?
What made the pain better? What made it worse?
Were you afraid of anything? What were you afraid of?
Did you feel as if you were in control? Did you think that you were allowed to alter the way you washed your burns or to stop for a moment so you could have a break?
What other feelings did you have on days you washed your own burns?
Did the dressing change seem to take a short time or a long time? What made it go slower or faster?
What was best about washing your own burns?
What was worst about washing your own burns?
Is there anything else about washing your own burns that is especially important for me to understand?
Would you like to add anything else?

3. Did you prefer to wash your own burns or to have the nurses wash your burns? Why is that your preference? On a 0-to-4 scale, where 0 is "I strongly do not prefer," and 4 is "I strongly prefer," how would you rate washing your own burns and how would you rate having the nurses wash your burns?

4. If you had a friend, call him Sam, who had just been burned and was given a choice of whether to wash the burns himself or to let the nurses wash the burns, what advice would you, as an expert at being a burn patient, give Sam?

5. When you have to do something painful to yourself like remove a Band-Aid, do you prefer to remove it quickly or slowly?

6. What kind of washing of your burns do you prefer when the nurse is doing the dressing change washing - fast or slow? Is this different for different parts of your body? What kind of washing of your burns do you prefer when you are doing the dressing change washing - fast or slow? Is this different for different parts of your body?

7. What kind of touch, firm or light, do you prefer when the nurse is doing the dressing change washing? Is this different for different parts of your body? What kind of touch, firm or light, do you prefer when you are doing the dressing change washing? Is this different for different parts of your body?

8. If you knew at the beginning of your hospitalization what you know now, is there anything you would have done differently?

9. Is there anything else about washing a patient's burns that you think it is important for me to understand?

Other questions may be asked so that patients can amplify their answers to the above questions and more fully describe dressing change washing.

Appendix F

Glossary

Debridement is the removal of tissue that is nonviable, further classified as soft debridement, in which tissue is removed with a dry or moist cloth or gauze, or sharp debridement, in which tissue is scraped, pulled or cut away using scissors, tweezers, forceps or the Norsen debridement tool (shaped like a flat, smooth spoon with a thin edge).

Donor is the area from which skin is removed for grafting of a burned area.

Dressings are, literally, bulky gauze placed over topical ointments over a burn or, commonly, topical ointments or skin coverings, gauze and outer flexible net that holds the gauze in place, collectively.

First-degree burn is a reddened, sensate, unblistered burn.

Full-thickness (F-T) is a burn that has had its underlying skin layer, the stratum germinativum, destroyed, and will heal only very slowly from the outside perimeter inward unless skin-grafting is performed. A full-thickness burn is often less painful than a partial-thickness burn because of damage to nerves.

Graft is a perforated or non-perforated sheet of skin taken from an unburned area and placed over a clean, fully-debrided full-thickness burn in order to establish wound closure.

Graft takedown is the initial removal of dressings over a three- to five-day-old graft, a delicate, precise, moderately painful, nurse-performed procedure.

Hydrotherapy (see Tubbing)

Partial-thickness (P-T) is a fully sensate burn that retains its stratum germinativum but may be grafted if hands or feet are involved, to minimize scarring and contractures. A partial-thickness burn can be either first- or second-degree.

PCA is patient-controlled analgesia, in which the patient is given direct control over incremental analgesic administration via a bedside pump, controlled by a push button. To prevent overdosing, a "lockout" interval, often of five minutes, exists, during which pushing the button does not deliver an increment.

Physical/occupational therapy is active and passive range of motion performed on the body/hands of a patient with actual or potential contractures. Physical/occupational therapy is often performed during the dressing change, when constricting dressings are removed and the patient is maximally medicated.

Premedication is intravenous (IV), intramuscular (IM) or oral (PO) medication given before a dressing change or procedure, a routine before dressing change in many burn units.

PRN is literally defined as pro re nata, for the emergent situation, and colloquially defined as medications given, at the nurse's discretion, only when needed.

Second-degree burn is a blistered, sensate partial-thickness burn.

Sharp debridement (see Debridement)

Soft debridement (see Debridement)

Tanking (see Tubbing)

TBSA is total body surface area or total burn surface area. It is expressed as a percentage.

TENS is transcutaneous electrical nerve stimulation, produced by a TENS machine that stimulates the large-fiber afferents that modulate the pain impulse.

Third-degree burn (see Full-thickness)

Topical is ointment, placed directly on the burn, then covered with gauze and flexible net. Occasionally, the term topical is used to refer to a single layer of medicated gauze or special plastic, placed directly on the burn, then covered with net.

Tubbing is the placing of the patient in the Hubbard tank or other large bathtub for soaking, washing and debridement.