EXPERIMENTAL PAIN IN HYPNOSIS RESEARCH: ISCHEMIC VS TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION (TENS)

By

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A dissertation submitted in partial fulfillment of
the requirements for the degree of

DOCTOR OF PHILOSOPHY

WASHINGTON STATE UNIVERSITY
College of Education

December 2009

To the Faculty of Washington State University:

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ACKNOWLEDGEMENTS

I would like to give a special thank you to Drs. Arreed and Marianne Barabasz, my principal committee members, for their most helpful feedback in keeping the process of this study focused throughout its entirety. You both managed to keep me on track and focused even when it felt like I was never going to get my dissertation complete. After all the revisions I can undoubtedly say my dissertation is far better than when it began. My gratitude is yours for all the hours spent reviewing drafts and providing me support during the program. I am indebted for the guidance you provided me during difficult times in this community. I will always remember sitting in your respective offices chatting with you throughout the multitude of my many various visits.

I also wish to thank Dr. Dennis Warner for all his contributions. I greatly appreciate your input and assistance in this study. You helped me take the knowledge I acquired and to always keep working to make sense of the data.

Finally, I offer my heartfelt gratitude to my family for their emotional and financial support throughout this entire process. Without your encouragement to support my ambitions, I could not have made it.

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Abstract

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December 2009

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The purpose of this study was to compare two types of experimental pain typically used in hypnosis research: transcutaneous electrical nerve stimulation (TENS) and ischemia on the basis of how closely each approximates clinical pain. Approximation reports were obtained using a semantic differential measure (Osgood, Suci, & Taunenbaum, 1950) in both awake and hypnosis conditions. This study also tested whether high hypnotizables differ in their ability to manage pain induced by TENS as compared to ischemic pain. The final sample was comprised of 50 participants in both pain conditions. Hypnotizability was assessed by the Stanford Hypnotic Clinical Scale (Morgan & Hilgard, 1975). Analyses showed that in the awake state TENS pain failed to closely approximate clinical pain versus ischemic pain. However, in the hypnotic state TENS pain was shown to more closely approximate clinical pain in contrast to ischemic pain. Analyses also revealed that high hypnotizables differ significantly in their ability to manage pain induced by TENS in contrast to ischemic pain. However, consistent with the literature, hypnosis was shown to significantly reduce pain perception versus the same level of painful stimulation in awake conditions.

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CHAPTER ONE

Statement of the Problem

Pain is a healthcare issue that results in substantial suffering in the world (Melzack, 1990). In America alone, almost 50 million suffer from chronic pain each year ("National Pain Survey", 1999). The cost to healthcare systems and in unemployment is staggering, reaching billions of dollars in cost to the public (Turk & Okifuji, 1998). More recently, specific estimates have approximated losses at $70 to $120 billion per anum (Stanos & Houle, 2006). Pain is a critical process necessary for the survival of an individual and allows for awareness regarding possible injury (Liebeskind, 1991). Pain can, quite literally, kill (Bonica, 1990). Risk of death by suicide among chronic pain patients is double that of controls (Tang & Crane, 2006). Further, the prevalence of suicidal ideation among chronic pain patients is roughly 20% and the lifetime prevalence of suicide attempts is roughly 5% to 14% (Tang & Crane, 2006). Only one in 4 persons experiencing chronic pain receives adequate treatment and, in those who obtain services, treatment is often ineffective or underutilized ("Chronic Pain in America Survey", 1999). The need for development and implementation of models for treating chronic pain that are clinically successful, well-organized, and fiscally reasonable is clear and has already been well documented in capitated health care systems (Walker, Brawer, Solomon, & Seay, in press). Therefore, it comes as no surprise that there has been a resurgence of interest in hypnosis as an alternative cost saving therapy for the treatment of pain (for summaries see Barabasz & Watkins, 2005, Lang, Benotsch, Fick, Lutgendorf, Berbaum, & Berbaum, 2000).

Theoretical Basis of Hypnosis

Ernest Hilgard (1977) proposed the neodissociation theory of hypnosis. According to the neodissociation theory, divisions between states of consciousness are not distinct but part of a continuum of consciousness representing transitional phases. Thus, one in an altered state is completely capable of immediate return to full arousal as the need or desire arises. Cognitive control structures are arranged in a hierarchical system with related but independent functions and goals (Hilgard, 1977; 1979). The functioning of cognitive control systems varies with the demands of the environment in which it exists. The "executive ego" oversees functioning of the system, which can become diversified under certain conditions (Hilgard, 1977; 1979). The executive ego is the managing director of the parts in the system, able to adjust the attentional systems to meet the demands from the environment. During hypnosis, the functioning of the executive ego is suppressed. Cognitive control hierarchy is altered such that what is typically voluntary may become involuntary, and vice versa (Hilgard, 1973; 1977). The absence of cognitive exertion in attention involves a dissociative process. Dissociation occurs as attention is narrowed or directed in a particular stimulus. An activity is "dissociated when one of them goes on automatically, with little conscious effort, as the other is carried out with attention focused on it "(Hilgard & LeBaron, 1982, p.4).

Hypnosis brings about the dissociation by decreasing stimulus input to the dominant cognitive processing system. By willing suspension of the executive ego's role, the individual allows the hypnotist to oversee attentional processes and direct attention to a specific area. This allows a situation in which the individual turns to internal stimulation which allows a less dominant system to become more active.

Dissociation in hypnosis is partial and serving a function and is not complete as seen in pathological illness. High hypnotizables differ from low hypnotizables in the ease with which they give up dominant processing systems and turn to internally subordinate processing systems.

The Experience of Pain

Hilgard and Hilgard (1994) noted the paradox of pain in that it is both beneficial and harmful at the same time. The information given by pain is helpful in locating the source of damage and thus treatment can be given (Barabasz at al., 2005, Hilgard et al., 1994). Also, pain can protect one from further injury until said condition is improved (Barabasz et al., 2005, Hilgard et al., 1994). Feeling no pain can have lethal consequences and pain that comes too late for treatment is the other side of the paradox (Barabasz et al., 2005, Hilgard et al., 1994,). Chronic pain can lead to severe depression, effects upon heart, kidneys, gastric and colonic processes, reduced efficiency in work and lessened enjoyment of life (Hilgard et al., 1994). Reflecting upon the human experience leads us to the inevitability of pain. Religion pays particular attention to pain such as the pain of childbirth (Hilgard et al., 1994). Even the symbol of the Cross connects pain to an understanding of human destiny; just as the word excruciating when applied to pain, derives from the word crucifixion (Barabasz et al., 2005).

Types of Pain

There are more types of pain than those listed here, but for the sake of brevity, only the types listed are those mentioned by Hilgard et al. (1994). Phantom limb pain seems to be rooted in some kind of memory; this kind of pain may be described as intractable, meaning the pain is stubborn, resists treatment and the tissue source of said

pain is lacking or non-existent (Hilgard et al., 1994, Melzak, 1973). Referred pain is felt in one place while the origin resides elsewhere (Hilgard et al., 1994, Melzak, 1973). Psychosomatic pain has its origins in the emotional meaning and the purposes pain may serve (Hilgard et al., 1994, Mersky & Spear, 1967).

Aspects of the Pain Experience

The problem of defining pain has a long and varied history. However, the subjective aspects of pain are often seen as critical to its understanding (Barabasz et al., 2005, Hilgard et al., 1994, Patterson et al., 2000). Scientific inquiry has helped identify two components of pain; the sensory and the suffering component (Barabasz et al., 2005, Hilgard et al., 1994). The sensory component provides information regarding location and intensity of whatever may be its source (Barabasz et al., 2005, Hilgard et al., 1994). The reaction to this sensory component is the suffering component and this describes how disturbing or bothersome the pain is to the patient (Barabasz et al., 2005). The sensory component may be described in a number of ways including hot, burning, cold, aching, intermittent, or continuous. The suffering component is expressed in a number of ways as well (e.g., crying out, autonomic response) (Barabasz et al., 2005, Hilgard et al., 1994). This classic interpretation contrasts with another interpretation wherein the two components come to be simultaneously, such that both are interacting pieces of the entire pain experience (Barabasz et al., 2005, Hilgard et al., 1994). Melzack and Torgerson further added to the aforementioned interpretation by adding a third component by way of an evaluative component of the total experience of pain (Hilgard et al., 1994). In the suffering component of pain it can be seen that there is something regarding reactions to pain whilst growing up that affects the manner in which the aversive quality of pain is

experienced (Hilgard et al., 1994). Situational factors may also play a role in the experience of pain as in the case of the injured athlete who has no recognition of their pain until after the completion of the play (Hilgard et al., 1994). Situational factors may also be seen in the experimental setting wherein the amount of pain felt correlates to the amount of pay obtained for enduring it, thus the participant promised more money felt correspondingly more pain (Lewin, 1965).

Physiology, Psychology, and Useful Theories of Pain

Attempts to understand the physiology and psychology of pain began in the nineteenth century in which two theories emerged; the Specificity Theory by Von Frey, and Goldscheider's Pattern Theory (Barabasz et al., 2005, Hilgard et al., 1994). Both theories, while significant for their times and beginnings, were subsequently superceded in 1965 by Melzack and Wall who proposed the Gate Control Theory (Barabasz et al., 2005, Gatchel, Peng, Peters, Fuchs, & Turk, 2007, Hilgard et al., 1994). Gate Control Theory accepts the physiology of two neural conducting systems from the spinal cord to a higher center of the brain, only after impulses go through the spinal cord as a result of peripheral stimulation (Barabasz et al., 2005, Gatchel et al., 2007, Hilgard et al., 1994). One system is pejoratively informative with data regarding both the location and intensity of stimulation without significant relation to the aversive quality of the stimulation (Barabasz et al., 2005, Gatchel et al., 2007, Hilgard et al., 1994). This system is called the Sensory Discriminative System (Gatchel et al., 2007, Hilgard et al., 1994). Contrarily, the Motivational Affective System involves motivation and emotion near the center of the brain regarding the suffering the pain causes (Barabasz et al., 2005, Gatchel et al., 2007, Hilgard et al., 1994). This theory is identified as seeing the two components

of pain aforementioned as occurring in tandem (Barabasz et al., 2005, Gatchel et al., 2007, Hilgard et al., 1994). Gate Control Theory further hypothesizes that big and little fibers that enter the spinal cord interrelate in such a way as to affect the pain information that is sent to the brain (Barabasz et al., 2005, Gatchel et al., 2007, Hilgard et al., 1994).

While heavily supported, Gate Control Theory has three difficulties. First, the complex nature of interconnections in the dorsal spinal gray matter limits making effective critical anatomical specifications of the gate control mechanism (Hilgard et al., 1994). Second, the required characteristics of interneurons has not been located (Barabasz et al., 2005, Hilgard et al., 1994). However, this limitation is somewhat mediated by the recent investigations of DePascalis and his colleagues that shed EEG and ERP support (DePascalis & Cacace, 2005). Third, part of the necessary interactions at neuronal and synaptic levels does not support details of the theory (Hilgard et al., 1994). However, three aspects of the theory are well established and must be included in any sufficient pain theory (Gatchel et al., 2007, Hilgard et al., 1994). First, two distinctive mechanisms, one data driven and the other motivational/affective are part of the total pattern of pain perception, which is supported neuroanatomically (Barabasz et al., 2005, Gatchel et al., 2007, Hilgard et al., 1994). Second, pain may be modified by concurrent stimulation of large fibers (Barabasz et al., 2005, Hilgard et al., 1994). Third, central control processes obviously affect the perception of aversive stimulation, which has been supported by reliable types of brain stimulation (Barabasz et al., 2005, Gatchel et al., 2007, Hilgard et al., 1994).

Pain research has endeavored to discover means of standardizing the induction of pain in order to advance knowledge of its properties. Such standardization further allows

for a meaningful way to assess the utility of various pain treatments (such as hypnosis) in both experimental and clinical contexts. An adequate stimulus for pain can be a chemical substance to which structures of the body are sensitive, many of which are amines or peptides (Barker & Levitan, 1974). The most familiar peptide known for pain is bradykinin, which develops into burn blisters and is responsible for their ongoing pain (Barker & Levitan, 1974). When injected into an artery, pain is perceived. "Pain sensitivity" is often used to characterize threshold pain; in other words the least amount of stimulation that may be detected as pain (Barabasz, 1982, Barabasz et al., 2005, Hilgard et al., 1994). Methods to experimentally induce such pain may include an instrument to stimulate an area on the forehead by radiant heat or an electrode for stimulation on a skin surface (Hilgard et al., 1994). Contrarily, the term "pain tolerance" is at the other extreme and is defined as the most pain an individual is willing to endure as the stimulus is progressively increased, or by the time elapsed at a given high level of stimulus intensity (Barabasz et al., 2005, Hilgard et al., 1994). Two kinds of stimulation were primarily used in Hilgard's laboratories and include cold pressor pain and ischemic pain (Hilgard et al., 1994).

Methods Controlling Clinical Pain: Medical, Physical, and Psychological

There are many treatments employed to control pain. Currently, drugs, surgery, non-drug, and non-surgical methods are used (Barabasz et al., 2005, Hilgard et al., 1994). Hypnosis has been used alone for pain managment but more often is used in combination with other methods (Hilgard et al., 1994). Primitive medicine for pain control looked to alcohol intoxication as a means of pain relief (Melzak, 1973). Trephining the skull for head pain is still used in parts of Africa (Melzak, 1974). The oldest physical methods to

control pain include hot or cold packs, mustard or other skin irritants, and cupping (Zborowski, 1969).

Medical

Medical aspects of pain control rest upon two categories of pain: pain brought to the medical professional and pain caused in the course of treatment, in surgery and the post-surgical period. Anesthesia is worthy of note as it is used to prevent pains caused by surgical methods (Hilgard et al., 1994). Non-surgical pain and pain that will not remit after surgery is best controlled via specific pain medications such as morphine and other narcotics derived from opium (Hilgard et al., 1994). A study of hospitalized patients given morphine for post-surgical pain has found that one-third of patients obtained relief above that of placebo, one third obtained the same benefit as placebo, and, finally, one third obtained less relief from that of placebo (Beecher, 1959). Beecher (1959) pointed out the need to control for placebo influences upon pain and modern studies endeavor to do just that. Even drugs such as morphine, with clear organic effects upon pain, also play upon learned components (Dinnerstein, Lowenthal, & Blitz, 1966). Valuable information learned from investigation into pain, especially when combined with hypnosis and other psychological treatments, points to the multifaceted and complex interactions with anxiety, expectations, and prior experience of the laboratory participant or clinical patient. Evidence of a psychological component to the responsiveness of the individual in no way denies the authenticity of organic components (Hilgard et al., 1994).

Surgical relief of pain rests upon known characteristics of the nervous system. However, successful surgeries (correct incision and healing of the surgical wound) does not always relieve the pain. One individual undergoing surgery finds the pain relieved

however, another individual, whose pain source is identically diagnosed via X-rays and other test methods, may not find any relief (Hilgard et al., 1994). For intractable pains especially, including neuralgias, phantom limb pains, and neck and back pains, surgery must be entered into cautiously with an awareness of the potential failures (Hilgard et al., 1994).

Physical

A number of physical methods currently treat pain by manipulating the surface of an individual's body: massage, hot and cold treatments, counterirritants, electrical stimulation, acupuncture, and audioanalgesia (Hilgard et al., 1994). Superficial electrical stimulation of the skin over the painful area has gained widespread acceptance as a means of pain relief whose mechanism of action is supported by the Gate Control Theory. One means of this type of stimulation is trans electro dermal neural stimulation (TENS). Pain relief is found in approximately ten to thirty percent of those suffering chronic pain; however, placebo effects have been noted in this treatment (Wall & Sweet, 1967, Long & Hagfors, 1975).

Acupuncture obtained widespread recognition as a viable means of treatment of pain after the Republic of China endorsed it and its subsequent propagation throughout the world beginning in 1950 (Bonica, 1974). While over-enthusiasm led to progressively outrageous claims of its effectiveness, it has gained a place as a non-surgical method of pain treatment (Hilgard et al., 1994). Auriculotherapy came to notoriety in France and is a form of acupuncture wherein all the needles are put into the external ear. However, it was without scientific basis beyond placebo and has become obscure as a viable treatment option for pain (Nogier, 1972).

Audioanalgesia is intended to reduce the pain of dental patients wherein patients played music at a level that "drowned" out the pain. However, its effectiveness was examined and found to be dependent upon accompanying suggestions of reduced pain (Melzack, Weisz, & Sprague, 1963). A noteworthy caveat exists in this pain management method since, according to the agreed upon APA definition of hypnosis (Green, Barabasz, Barrett, & Montgomery, 2005), an "initial suggestion" can constitute the hypnotic induction. Therefore, audioanalgesia may have unwittingly stumbled upon a hypnotic effect. Without the specific suggestions added, there existed a risk to the eardrums as the music was often set at too high a level (Melzack et al., 1963).

Physical medicine, superficial electrical stimulation, acupuncture, and audioanalgesia are all regarded as potential physical methods for the alleviation of pain and are all effective to some extent, especially in favorable psychological settings (Hilgard et al., 1994).

Psychological

Psychological methods for the relief of pain may be classified into three subcategories: first, principles of learning in which pain is treated as a learned response which is subsequently unlearned; second, dynamic principles that treat pain according to its personal significance to the individual; and third, suggestion and hypnosis (Hilgard et al., 1994).

Principles of Learning

Behavior modification is the term used to describe the application of learning principles to change behavior in desired directions. The rationale behind behavior modification is that if pain can be learned and remembered, it can be unlearned and

forgotten (Bandura, 1969). Thus, these principles may be applied to pain as though it were a conditioned response. Repeated association of a reinforcer with pain establishes a contingency between them such that sympathy may be contingent on signs of distress. Thus, if habitual pain is to be reduced, the contingency must be interrupted so extinction can occur (Bandura, 1969). Thus, if elimination of sympathy can occur the pain behavior will extinguish.

Biofeedback is based upon amplifying part of an individual's typically involuntary process in order for the individual to increase their awareness of said processes (Kamiya, 1969). Once awareness is created, the individual may obtain control to their benefit. Again, biofeedback is a learning method with conditioning as in operant conditioning but importance is placed upon learning techniques of control, and this data-driven feedback has components beyond typical reinforcement (Hilgard et al., 1994).

The Seattle Pain Clinic, a team of workers knowledgeable with a multiplicity of diagnostic and treatment methods, combines its skills to provide diagnosis and treatment beyond that of any one specialist focusing on debilitating chronic pains (Hilgard et al., 1994). The clinic attributes pain as a learned response and the operant conditioning program in Seattle, initiated in 1967, is well known for successful treatment for chronic pain patients with maintained gains at two-year follow-up (Bonica, 1974). Thus, psychological treatments for chronic pain may obtain pain reduction allowing for more normal lives as residual pain endures (Hilgard et al., 1994).

Dynamic Principles

The dynamic principles of pain treatment focus on the client's pain and treat it according to its personal significance to the individual (Hilgard et al., 1994). Since pain

may be referred, if this pain serves a psychodynamic function (e.g., masochistic needs, underlying guilt), treatment directed at the pain site does not stand a great likelihood of resolving the issue of pain (Barabasz et al., 2005). Hence, a more intensive and insightful kind of treatment may be necessary--for example, hypnoanalytic psychotherapy (Watkins & Watkins, 1997).

Hypnosis and Suggestion

Veridical hypnotic effects go beyond mere suggestion. Suggestion is only one component of hypnosis. Suggestion and hypnosis are not equivalent (Barabasz et al., 2005). Suggestion alone without hypnosis is essentially equivalent to placebo (McGlashan, Evans, & Orne, 1969). From the 1800's and into the 1900's Elliotson, Esdaile, and Ward were but few who helped bring hypnosis onto the world stage as a viable means to manage pain (see Barabasz & Watkins, 2005). Hilgard et al., (1994) notes three 'classes' of procedures with hypnosis for pain: direct suggestions of pain reduction, changing the experience of pain even though pain may persist, and, finally, moving attention away from pain and its concomitant source. Much more may be said about hypnosis and its concomitant effects. However, this and other salient details to hypnosis will be explained later. Hypnosis is notably more efficacious in relieving organic pains rather than pains originating from psychological functional sources of underlying needs in the patient (Barabasz et al., 2005).

Leaders in the field of hypnosis and pain reviewed all randomized controlled studies involving hypnosis and clinical pain with remarkable results, finding hypnosis beneficial for all types of clinical pain problems (Patterson & Jensen, 2003). Further, Jensen and Patterson (2006) reviewed all randomized controlled acute procedural pain

studies finding that hypnosis yields consistent and dramatic positive impact. Finally, Elkins, Jensen, and Patterson (2007) reviewed all studies of hypnosis and clinical pain and found enough controlled studies have been conducted to consider hypnosis as a cost effective treatment option for both chronic and acute pain.

Hypnosis has been found to be of significant benefit for practically every clinical pain problem conceivable, including dental work, cancer, chronic pain, reflex sympathetic dystrophy, spinal cord injury, arthritis, temporomandibular joint disorder, multiple sclerosis, causalgia, postsurgical pain, and headaches (Barabasz et al., 2005, Elkins, Jensen, & Patterson, 2007, Patterson et al., 2003).

Patterson et al.'s (2003), Jensen and Patterson's (2006), and Elkins et al.'s (2007) investigations of the use of hypnosis for clinical pain found hypnosis has a "reliable and significant"(p.3) (Patterson et al., 2003) impact on acute procedural pain and chronic pain conditions in their reviews of the then current literature of randomized controlled studies. Further, Elkins et al., (2007) note that now there are an adequate number of controlled studies of hypnosis allowing for "meaningful conclusions" regarding chronic pain. The authors go on to report that studies of hypnosis and chronic pain that utilize multiple outcome measures and follow ups of adequate duration will greatly improve future research. Patterson et al.'s (2003) and Jensen et al.'s, (2006) findings were previously supported by Holyroyd (1996) in her review of numerous clinical studies which report reductions of pain in a multiplicity of both chronic (eg., cancer) and acute conditions (e.g., painful medical procedures) using hypnosis.

Purpose

The purpose of the present study is to compare experimentally induced ishemic pain and pain induced by electrical stimulation employing current instrumentation and methodology. Hilgard (1991) hypothesized that ischemic induced pain is superior to pain induced by electrical stimulation in approximating clinical pain as it was induced at that time.

Since Hilgard and Hilgard's original edition in 1975 was released, experimentally induced pain with electrical stimulation essentially fell into disuse after Barabasz' (1982) study. However, the recent investigations of DePascalis and his colleagues (DePascalis & Cacace, 2005, DePascalis, Cacae, & Massicolle, 2004, DePascalis, Chiaradia, & Carotenuto 2002, DePascalis, Magurano, Bellusci, & Chen 2001, DePascalis, Magurano, & Bellusci, 1999) in his lab at the University of Rome warrant further examination for two reasons. One, the methodology to induce pain has made significant technological improvements to provide for a pain source more readily amenable to the open ended scales utilized in cold pressor and ischemic pain. Two, the DePascalis studies show new physiological measures related with the administration of electrically induced pain, which provide much evidence of its effectiveness. The validity of its use seems to clearly support criterion at the construct level given corroborating physiological measures in approximating clinical pain.

Currently, however, ischemic pain has a number of physical limitations (numerous different types of medical problems preclude possible testing) for obtaining research participants, yet remains the dominant method in research for experimentally induced pain. Modern electrically induced pain with a transcutaneous electrical nerve

stimulation (TENS) style unit using the De Pascalis methodology has not been tested against ischemic pain and it has not been assessed using the same pain submaximal rating measure Hilgard (1994) developed for ischemic and cold pressor pain. Such an investigation may allow for a valid and reliable rationale for the use of electrically induced pain in experimental settings, a significant boon to research to be conducted in the future and for pre-existing research using electrical stimulation for induced pain without rationale.

On the basis of the literature the following were generated:

Hypothesis:

1. In contrast to ishcemic pain, electrically induced TENS pain will produce ratings of pain perception that are significantly more similar to actual pain response (accident and medical pains previously exposed by each participant) ($p<.05$).

Question:

2. Do high hypnotizables differ in their ability to manage pain induced by electrical stimulation as compared to ischemic pain?

CHAPTER TWO

Hypnosis & Clinical Pain

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Hypnosis and Laboratory Pain

The efficacy of hypnotic analgesia in reducing pain has been demonstrated in experimental settings in numerous studies (e.g., Appel & Bleiberg, 2005/2006, Barabasz et al., 2005, DePascalis, Magurano, & Bellusci, 1999, Freeman, Barabasz, & Barabasz, 2000, Hilgard & Hilgard, 1994, Miller, Barabasz, & Barabasz, 1991, Sharav & Tal,

2004). Researchers wanting to employ experimentally induced pain struggled to find a means to induce pain that approximates clinical pain enough to be worth investigation and tolerable enough for participants to be willing to undergo it in order to contribute to scientific knowledge (Hilgard et al., 1994). However, Hilgard's lab at Stanford led the way and identified cold pressor pain and ischemic pain as verified means of experimentally produced pain (Barabasz & Watkins, 2005).

McGlashan, Evans, and Orne (1969) noted the difficulty with electrical stimulation as a viable method of experimentally produced pain: "Laboratory methods of inducing pain, particularly by electric shock, are usually different in kind, momentary and no so intense, and not so threatening to the individual as clinical pain"(p.232). The aforementioned rationale was enough to primarily suspend the use of electrical stimulation for the next few decades until technology provided a solution to the problem of using electrical stimulation. Evidence of this development is most notable in the work of De Pascalis at the University of Rome, who has used electrical stimulation successfully in hypnosis as a means to induce experimental pain with substantive corroborating physiological evidence of its efficacy (DePascalis & Cacace, 2005, DePascalis, Cacae, & Massicolle, 2004, DePascalis, Chiaradia, & Carotenuto 2002, DePascalis, Magurano, Bellusci, & Chen 2001, DePascalis, Magurano, & Bellusci, 1999)

The authors, McGlashan et al., (1969) went on to provide a rationale for the use of ischemic pain stating, "This pain involves a dull aching sensation which increases in intensity with increasing ischemia…[which] has many of the qualities of clinical pain. Unlike electric shock, ischemic pain is not a transient sensation" (p.232). Finally, these

authors note that another advantage of ischemic pain is that the participant controls the rate of work, and therefore, the level of pain experienced.

Hilgard et al.'s (1994) work revealed that a participant's hypnotizability is able to predict hypnotic analgesia. Their work, and that of subsequent investigators may be seen in terms of the trait theory of hypnosis that has demonstrated hypnotizability to be a measurable construct that is highly stable (i.e., .80-.90 test-retest correlations after 10 years; (Hilgard et al., 1994)). Montgomery et al., (2000) reported a meta-analysis of the effects of hypnosis on pain, consistent with earlier findings of Hilgard and colleagues, such that the effect size of hypnotic analgesia in the laboratory was associated with hypnotizability across studies during experimental pain paradigms (e.g., cold pressor tasks, ischemic tasks). McGlashan et al.'s (1969) landmark study on the effect of placebo in relation to hypnotizability demonstrated that individuals with high or low hypnotizability did not differ in their placebo response to a "powerful analgesic drug" but only the highs were able to achieve dramatically as well as significantly reduced pain response in the hypnosis condition.

Studies of physiological correlates of laboratory pain reduction through hypnotic analgesia include sympathetic responses, electrocortical activity, and regional blood brain flow (Fromm & Nash, 1992, Hilgard et al, 1994). Since physiological responses to pain stimuli may be influenced less by subject bias than self-report, it has been suggested that the lack of consistent effect on sympathetic responses suggests hypnosis does not affect actual experienced pain but instead only the willingness to report it (Patterson et al., 2003). The sympathetic response alone, however, is but a subset of physiological responses to pain, and as such, says nothing regarding the effects of hypnosis on the pain

experience (Barabasz et al., 2005, Fromm & Nash, 1991, Hilgard et al., 1994). A more recent body of research regarding sensory versus affective pain effects suggests that neurophysiological changes are associated with hypnotic analgesia in receptive individuals and that multiple physiological mechanisms appear to play a function in the pain reduction connected with hypnotic suggestions for relief of pain (Barabasz et al., 2005, Fromm & Nash, 1992, Patterson et al., 2003). In conclusion, a variety of studies demonstrate hypnotic suggestions of analgesia can modulate both self-reports of painful experiences and physiological responses (DePascalis, Cacae, & Massicolle, 2004, DePascalis, Magurano, & Bellusci, 1999, Fromm & Nash, 1991).

Types of Experimentally Induced Pain

Cold Pressor Pain

Wolf and Hardy (1941) were the first to examine cold pressor as a viable means to induce pain (Barabasz et al., 2005, Hilgard et al., 1994). Cold pressor pain relies on circulating ice water such that if a hand and forearm are put into circulating ice water the sensation of coldness rapidly becomes painful (Hilgard et al., 1994). This sort of pain increases quite quickly and reaches its maximum within one minute (Hilgard et al., 1994). The standard practice asks for a pain report every five seconds on a basic numerical scale, with zero as no pain and progressively to ten as a critical value, at which point the individual would “very much like to remove the hand from the water” (p.39) (Hilgard et al., 1994). Individuals can tolerate more pain than this, and if asked, the individual’s report will continue beyond ten to ensure linear reporting (Hilgard et al., 1994).

As such, there is evidence that reports on the basic numerical scale obtains a dependable measure of pain felt based on the quite orderly relationship to degree of the water temperature; the more cold the water is the more pain that is reported (Hilgard et al., 1994). A number of limitations exist in the use of cold pressor pain such that it has gradually been utilized less in the research setting than ischemic pain, and more recently electrical stimulation (Barabasz et al., 2005). A complex underlying process belies the orderliness of pain reports. The exact increase in the physical stimulus of pain when the hand and arm is in the water becomes difficult to specify as the deeper layers of skin cool less rapidly than outer layers and because differences in blood circulation exist in response to the cold water and cold water has the stress of cold, in addition to the pain (Barabasz et al., 2005, Fromm & Nash, 1991, Hilgard et al., 1994). In addition to the previous disadvantages of cold pressor pain, other disadvantages include the cardiovascular response that occurs reflexively to the cold and, finally, the need for the individual to differentiate the sensory aspect of pain from the sensory aspect of progressive coldness (Barabasz et al., 2005, Hilgard et al., 1994).

Ischemic Pain

Ischemic pain is considered to approximate the postoperative pain of surgical patients and is thought to react as clinical pains do to chemical analgesics (Hilgard et al., 1994). The pain produced by ischemia is a well-established phenomena. It is regarded to closely approximate clinical pain and has a most significant advantage in translation from experimental to clinical applications (Barabasz & Watkins, 2005, Hilgard et al., 1994, McGlashan et al., 1969). Hilgard adopted a method developed by Smith, Egbert, Markowitz, Mosteller, & Beecher, (1966) while at Beecher's laboratory at Harvard and

named it the submaximal effort tourniquet technique (Hilgard et al., 1994). In this procedure, the tourniquet is put on the individual's arm and the arm is deprived of blood by raising it and wrapping it to the elbow in an elastic bandage (Hilgard et al., 1994). Then the tourniquet is inflated to 250 mm. Subsequently, the individual squeezes a dynamometer at a controlled rate against a constant load of 10 kg for twenty squeezes, and waits (Hilgard et al., 1994). The pain increases slowly in the beginning but, over time, becomes unbearable, although the amount of time this takes is significantly longer than for cold pressor pain (Barabasz et al., 2005, Hilgard et al., 1994, McGlashan et al., 1969). An advantage of the pain mounting slowly allows for the hypnotic participant to obtain a confident analgesic state, whereas, in cold pressor pain, the shock of the ice water occurs instantly (Hilgard, 1994). A noteworthy feature of ischemic pain is that it responds to morphine, as post-surgical pains would; thus, the amount of reported pain is proportionally reduced by amount of morphine administration (Hilgard et al., 1994). Pain reports for a given subject are very reliable from one administration to the next and little difference is observed between one administration and the next (Hilgard et al., 1994). A rating form for suffering is sometimes employed to evaluate general annoyance, disturbance, or distress as a consequence or accompaniment of the pain (Hilgard et al., 1994). Typically, suffering is rated as less intense than sensory pain (Hilgard et al., 1994). Changes in physiological measures, mainly increases in heart rate and blood pressure, are observed as pain increases. However, these measurements are not so distinct from each other as verbal reports of pain (Hilgard et al., 1994).

Electrical Stimulation

In the beginning of research into experimentally produced pains, electrical stimulation as a viable means for experimentally produced pain was utilized with inconsistent utility and it essentially fell into disuse after Barabasz' (1982) study due to the technological limitations in approximating clinical pain as explained above by McGlashan et al., (1969). Research using electrical stimulation was pejoratively confounded initially by the lack of evidence, and later consensus, regarding the involvement of physiological and neurophysiological correlates of hypnotically modulated pain perception. In addition, there was a lack of well designed experimental studies (Barabasz et al., 2005, Fromm & Nash, 1991). The difficulty with electrical stimulation, at that time was due to the transient nature of electrical stimulation, which would not provide substantive and exacting evidence for corroborating physiological and neurophysiological correlates. As time went on, the development of technological sophistication in neurophysiological correlates in the hypnotic modulation of pain perception demonstrated efficacy beginning in the 1980's in prominent studies by Barabasz and Barabasz (1989), Talbot, Marrett, Evans, Meyer, Bushnell, and Duncan (1991), and Willis (1985).

However, technology in the 1990's began to allow for electrical stimulation to be considered appropriate to approximate clinical pain because of a reduction in the transient nature of the pain, most especially with use of an odd ball paradigm, brought to notoriety by the DePascalis lab in Rome. DePascalis' research is the first to expertly bring together the technological advancements in electrically produced pain and the technological advancements in neurophysiological correlates of hypnotic modulation of pain perception

in well-designed studies. However, it is noteworthy that no rationale exists in DePascalis' research for how well the newly implemented electrically induced pain approximates clinical pain, the benchmark for the utility of experimentally induced pain (Barabasz et al., 2005, Fromm & Nash, 1991, Hilgard et al, 1994).

Research Employing Experimentally Produced Pain

Ischemic Pain Studies

McGlashan et al.'s (1969) landmark study on the effect of placebo in relation to hypnotizability demonstrated that only the high hypnotizables produced significantly reduced pain reports when exposed to hypnosis but that the lows were unable to do so in the identical condition. This study showed definitively that hypnotic reductions in pain are due specifically to hypnosis and that hypnosis does significantly more than placebo. While a critical benchmark in the hypnosis literature, this study utilized ischemic pain as a means to experimentally induce pain. The authors intended to clarify two mechanisms that comprise hypnotic analgesia: the first mechanism may be explained by nonspecific effects of the placebo response in hypnosis; the second, a consequence of altered perception of pain while during "deep" hypnosis. Participants were assessed for high and low hypnotizability to be placed into corresponding groups with the Harvard Group Scale of Hypnotic Susceptibility: Form A (HGSHS:A) and the Stanford Hypnotic Susceptibility Scale: Form C (SHSS:C).

Participants completed an ischemic pain task in multiple sessions, one inducing hypnotic analgesia and another a placebo response to a "powerful analgesic drug". The authors, McGlashan et al., (1969), went on to provide a rationale for the use of ischemic pain stating, "This pain involves a dull aching sensation which increases in intensity with

increasing ischemia…[which] has many of the qualities of clinical pain. Unlike electric shock, ischemic pain is not a transient sensation" (p.232). Finally, these authors note that another advantage of ischemic pain is that the participant controls the rate of work, and, therefore, the level of pain experienced (McGlashan et al., 1969).

Unique procedures enabled the authors to construct expectations that both treatment condition groups would be able to decrease pain successfully. The authors attempted to create a belief in the efficacy of hypnotic analgesia for the low hypnotizables to evaluate the potential placebo response. If high hypnotizables demonstrated a larger analgesic response in hypnosis, the result could not be attributed to placebo alone. The authors divided the study into three parts: (a) baseline pain response measures (threshold & tolerance); (b) hypnotic analgesia; (c) placebo analgesia. Both groups were instructed that the "powerful analgesic drug" produces the greatest pain relief possible. The authors compared pain relief in the hypnotic analgesia condition to the placebo analgesic condition to determine if hypnosis was viable as a treatment for pain. The placebo analgesia group was double blind as the experimenter was under the belief that half of the group received the real "drug" while the other half received a placebo. However, no actual drug was used in any of the conditions in this study. In both high and low hypnotizable groups, differences in pain threshold and tolerance relative to baseline were assessed and compared to changes in individual subjective ratings of pain intensity.

In summary, results revealed pain reduction was similar for the low hypnotizables in both the placebo and hypnosis condition. High hypnotizables in the hypnosis condition significantly reduced pain reports whereas the low hypnotizables in the

hypnosis condition were unable to do so. Additional results revealed high hypnotizables in the placebo condition rated pain intensity lower than the low hypnotizables also in the placebo condition. McGlashan et al. (1969) proposed that the results of their study lend support in determining that hypnosis does much more than placebo and that hypnotic reductions in pain are specifically due to hypnosis. Based on the author's study it may be reported that the placebo response is more efficacious for low hypnotizables than high hypnotizables and those highs and lows respectively, use different mechanisms to obtain pain relief. This study is salient to current hypnosis research and valuable to relieving clinical pain because it clearly showed hypnosis did more to manage pain than did placebo.

The well known experiment by Knox, Morgan, and Hilgard (1974) examined the effects of hypnosis on verbal reports of pain and suffering in managing experimentally induced ischemic pain in eight highly hypnotizables undergraduate students scoring at least a 10 as measured by the SHSS:C (Weitzenhoffer & Hilgard, 1962). This study is acknowledged by E.R. Hilgard to be the basis for experimentally induced pain control through hypnosis and was the first published investigation from his laboratory in which a suffering scale, along with a sensory pain scale, was utilized (Hilgard et al., 1994). The authors defined suffering as "something other than the localized effect of painful stimulations, having to do with general annoyance, disturbance, or distress as a consequence or accompaniment of the pain" (p.34). It is further reported that an individual may have pain without distress and, vice versa, distress without pain. Participants had little difficulty providing their own interpretations to the distinction.

Experimental conditions included normal wakefulness, hypnosis without anesthesia, and hypnosis with suggested anesthesia. Participants distinguished between felt sensory pain and the concomitant suffering in verbal reports on numerical scales. Overall, the participants reported suffering as less intense than sensory pain. Hypnotic analgesic suggestions reduced sensory pain and suffering (in "open" reports) by about 90% for all participants. Three of the high hypnotizables eliminated sensory pain and suffering completely. However, “hidden” reports of pain and suffering during hypnotic analgesia, obtained through automatic talking, revealed few differences in their “hidden” report from participants in hypnosis without analgesic suggestions. The authors suggest the possibility of two cognitive systems from the Gate Control Theory, which are the sensory discriminative pain system, and the motivational affective pain system, which are processing information at dissociated levels of awareness. The presence of the hidden observer who may acknowledge pain without a conscious awareness of it, does not cast doubt on the clinical effectiveness of hypnosis in pain reduction.

A controlled experiment conducted by Barabasz and Barabasz (1989) demonstrated a significant reduction in chronic pain consistent with a concomitant reduction on an experimentally induced pain measure (ischemia) following enhancement of hypnotizability after REST sessions. Specifically, the authors investigated whether hypnotizability could be enhanced by restricted environmental stimulation therapy (REST) with 20 adult outpatients (aged 23-57 yrs). The participants had demonstrated low hypnotizability after 10-12 hypnosis plateau sessions and were suffering from chronic pain (arthrochondritis, arthritis, cancer, multiple sclerosis, and back pain) (Barabasz et al., 1989). The authors sought to demonstrate REST’s effectiveness in a

clinical context and bridge the gap between experimental hypnosis pain control results and results in the clinical arena.

Two experimental conditions and two control conditions were utilized. In the experimental and control conditions, subjects were divided into groups one which had a high and the other which had a low level of demand characteristics. The high demand experimental condition involved instructions emphasizing "hypnosis results" and investigating "how deeply you can be hypnotized" (p.221). The low demand experimental condition involved instructions emphasizing "psychophysiological results"(p.221). In all high demand cases, situational stimuli (lab coats, medical tray, release button, serious manner) were intended to reflect high experimental demand characteristics while low demand situational stimuli (regular clothing, no medical tray or release button) were intended to minimize experimental demand characteristics. The experimental REST condition and the control condition were divided into high and low demand group. Situational demand characteristics, as detailed by Orne (1962), seek to influence hypnotic performance in a specific manner depending upon high or low demand. The Stanford Hypnotic Susceptibility Scale, Form C (SHSS:C) was administered pre and post treatment. Ischemic pain was induced using the submaximum effort tourniquet technique (Hilgard et al., 1994). Pain is measured with a pain report every five seconds on a basic numerical scale, with zero as no pain and progressively to ten as a critical value. Individuals can tolerate more pain than this and, if asked, will continue to report beyond ten (Hilgard et al., 1994). Reports on the basic numerical scale obtain a dependable measure of pain felt based on the orderly relationship to degree of pain experienced if reporting may continue beyond ten to ensure linear reporting of pain.

Results demonstrated that subsequent to six hours of REST, significant increases in SHSS:C scores were found for high and low demand experimental groups, and for the high demand control group with no such increases for the low demand control group. Significant decreases in pain scores were observed for high and low demand REST groups while no significant decreases in pain score were observed for high or low demand control groups signifying a weak effect of demand characteristics. Independent post-experimental inquiry indicated all participant's believed they received active treatments.

A significant limitation of the study was the clinical constraints of chronic patient care such that all participants were given posthypnotic suggestions for anesthesia. More specifically, this limits interpretation of the clinical data since it may not be determined if lowered pain reports of REST participants may be attributed to the posthypnotic suggestion due to enhanced hypnotizability or if this was a "non-suggested collateral consequence " (p. 223) of REST. Also, intervening clinical treatment variables such as changes in pain medication for two participants and depression medication added post experimentally for two participants suggest caution in interpreting the data. However, the study demonstrates REST's effectiveness in a clinical context by demonstrably bridging the gap between experimental hypnosis pain control results and pain control results in the clinical arena. In conclusion, this study greatly contributes to the hypnosis literature because of a lack of such similar studies.

DeBenedittis, Panerai, and Villamira (1989) investigated the effects of hypnotic analgesia and hypnotizability on experimentally induced ischemic pain while taking into account pain and distress tolerance, anxiety levels, and neurochemical correlates (plasma

concentrations of beta-endorphin and adrenocorticotropic hormone (ACTH). Participants (nine males and twelve female university participants at the University of Milan) included 11 high-hypnotizable participants (mean score = 10.1) and 10 low-hypnotizable participants (means score = 2.8), as determined by SHSS: C (Weitzenhoffer et al., 1962) who were administered a pain test in both waking and hypnotic conditions. Pain and distress tolerance, anxiety levels, and neurochemical correlates were measured. Results confirmed significant increases of pain and distress tolerance during hypnosis compared with the waking state. There was a positive relationship between pain relief and hypnotizability such that high hypnotizables demonstrated significant relief. Distress was reduced significantly more than pain in high-hypnotizable participants. Participants found the difference between pain and distress easy to distinguish. Anxiety reduction was not found to be related to hypnotic analgesia and no significant change was observed in beta endorphin levels for high or low hypnotizables. Similarly, no significant observable variation, regardless of hypnotizability, in any condition during ischemia was discovered for adrenocorticotropic hormone (ACTH).

One limitation of the study included the lack of continued pain reports after ten in order to allow for more linear measurement of pain reporting, which resulted in the authors adopting a “relative” pain tolerance, thus the pain intensity may not have been enough. Further limitations included limiting ischemic pain to 25 minutes maximum, which ultimately affected the outcome such that high hypnotizables were not significantly different from the lows in pain tolerance. Another limitation includes the possibility of order and practice effects due to no randomization of the experimental conditions due to the methodological limitations needed in order to determine beta

endorphin levels and ACTH. Finally, the authors divided the participants into two new groupings on the basis of 'hypnotic performance' rather than SHSS:C scores in order to assess pain tolerance for neurochemical correlates, thus the derived data are not from the SHSS:C, making comparisons to other studies difficult.

A strength of the study was the method to induce ischemic pain, which replicated the submaximum effort tourniquet technique procedure developed by Hilgard et al., (1994) exactly. Also, the authors used pain and distress measures developed by Hilgard et al., (1994) such that ten was a critical or anchoring point at which the participant would very much like to have the cuff removed but the researchers were very careful not to make pain tolerance a measure of heroism. Another strength included the specific detail of the methodology allowing for easy replication.

Although this study had a number of limitations, it significantly added to the hypnosis literature by demonstrating hypnotic effectiveness in pain and distress reduction in experimentally induced ischemic pain. It provided additional evidence that pain and distress reductions are positively related to hypnotizability, and that high hypnotizables reduce distress more than pain, which provides support for the neo-dissociative theory of hypnosis. It showed that hypnotic analgesic effects upon pain reduction are unrelated to anxiety reduction. The predominant finding is that hypnosis does significantly much more than placebo to reduce pain perception.

Electrical Stimulation Studies

A well known electrical stimulation study investigated the effects of restricted environmental stimulation technique (REST) on pain threshold, pain tolerance, and hypnotizability using the Stanford Hypnotic Clinical Scale (SHCS) in 10 subjects

(Barabasz, 1982). Barabasz' study intended to determine if REST increases hypnotizability and addressed methodological weaknesses from previous REST research. The SHCS was modified to include a posthypnotic suggestion to create an analgesic glove on the back of the right hand. A Lafayette 82450 shocker was used and concentric electrodes were attached to the back of the subjects right hand with a Velcro stretch band. A submaximal endurance instruction helped minimize heroism and develop the pain test procedure. Occipital EEG alpha, skin conductance, and peripheral, core, and chamber temperature data were measured prior to REST, immediately after REST, and ten to fourteen days afterwards. A control group, also of 10 subjects, was utilized to assess effects of repeated hypnosis and demand characteristics upon hypnotizability scores. A multivariate analysis of variance revealed SHCS and pain tolerance scores significantly increased for subjects exposed to hypnosis immediately after REST administration and 10-14 days later. Orne's (1959) post experimental inquiry showed demand characteristics did not account for the results. The study incorporated provisions to remedy previous methodological limitations in studies modifying hypnotizability and in studies utilizing REST. The methods section is clear and easy to understand and is written in a manner detailed enough to allow for replication. This study appears methodologically sound and demonstrates important significant effects, which substantially contributes to the hypnosis literature on the modifiability of hypnotic responsiveness and to the effects of hypnosis on pain management.

DePascalis, Magurano, and Bellusci (1999) investigated pain perception and correlations with hypnotizability by somatosensory event related potentials and skin conductance responses in 10 high, 9 mid, and 10 low hypnotizable participants selected

with the SHSS:C (Weitzenhoffer & Hilgard, 1962). Participants were assigned to the high hypnotizable group (N = 10, M = 10.2, SD = .60) when their score on the SHSS: C was one standard deviation above the group mean (N = 79, M = 6.8, SD = 2.53). Similarly, participants assigned to the low hypnotizable group (N = 10, M = 3.6, SD = .5) when their score was one standard deviation below the group mean. Participants were assigned the mid hypnotizable group (N = 9, M = 7.3, SD = 0.7) when their score was within one standard deviation of the group mean. Four conditions of hypnotic suggestion were present: deep relaxation, dissociated imagery, focused analgesia, and placebo. In each condition the participant was required to push a button as soon as possible after the painful electric stimulus was delivered to the ventral part of the right wrist. Behavioral measures to assess task performance included: (a) sensory threshold; (b) pain threshold; (c) reaction time to button press; (d) omission errors (number of missed presses to target presentation).

Two “pure” tin electrodes (1.2 cm in diameter) were affixed to the right wrist and pulses generated via a stimulator that delivered electrical pulses of constant current intensity and triggered externally from a personal computer. Standard stimuli comprised a bipolar pulse of two pulses of .5 milliseconds duration each with an interpulse interval of 20 milliseconds. The target stimulus was comprised of a 60 millisecond pulse train made by pairing three standard stimuli. Both target and standard stimuli were given at an intensity .5 mA over pain threshold at a constant interstimulus interval of 1.9 seconds. Each condition contained both target and standard stimuli through odd-ball paradigm in which infrequent targets occur 14.2% and standard targets occur 85.8% of the time. Finally, 156 electrical stimuli comprised each experimental condition, totaling 780

stimuli for each participant. The extremely high number of total stimuli appears due to the infrequent targeted painful electrical stimuli (14.2%) being analyzed for the purposes of the experiment; thus, the need for a great total number of presented stimuli.

A limitation of the current study is that, while pain thresholds were established using two separate 20 point continuous scales, no reliability or validity for these scales were reported and no rationale was provided. Another limitation is the lack of provided rationale for why electrical stimulation was used. Finally, another limitation of the study is the lack of detail regarding the specific suggestions in the hypnosis conditions, which make replication difficult.

The authors report that SERP peaks were most significant for high hypnotizables and displayed higher N2 peaks, especially in dissociative imagery and focused analgesia, and smaller P3 peaks in the hypnotic analgesia condition (unusual since negative emotional stimuli typically produces increased P3 peaks). The authors concluded that their outcomes indicated an increased inhibitory processing to painful stimulation during hypnotic analgesia. The authors reported that the high hypnotizable participants demonstrated the most significant reductions in pain and distress levels when compared to their mid and low hypnotizable counterparts in the focused analgesia hypnosis condition. The authors also reported that it was the high hypnotizables who demonstrated significant increases in both sensory and pain thresholds, the greatest number of omitted reaction time responses, faster reaction times, and smaller number of evoked skin conductance responses, when compared to their mid and low hypnotizable counterparts. This study utilized far more sophisticated equipment as a result of tremendous technological advances to experimentally induce pain through electrical stimulation than

in older studies (i.e. Barabasz, 1982). The validity of electrical stimulation use clearly supports criterion at the construct level given the corroboration of the physiological measures. Thus, in conclusion, this study appears primarily methodologically sound and demonstrates notable effects that contribute a great deal to the hypnosis literature.

The purpose of an experiment by DePascalis, Magurano, Bellusci, & Chen (2001) was to determine the electrocortical and autonomic responses to odd-ball standard (frequent 85.8%) stimuli in multiple awake and hypnotic analgesia conditions. By using somatosensory event related potentials and autonomic responses obtained from standard stimuli, the experiment had two aims: (a) to validate "previous physiological and behavioral findings obtained with odd-ball target stimuli" (p.1476) and (b) to determine to what extent pain reduction in hypnosis is a "multi-component process" creating an inhibitory effect on pain perception.

The authors utilized the data set obtained from a previous study by the first author, DePascalis et al., (1999), in order to evaluate frequent stimuli (85.8%) from an odd ball paradigm for analyses. DePascalis et al. (2001) provided an excellent rationale for the experiment's outcome measures. Specifically, the authors noted the rationale for evoking SERPs as being empirically demonstrated as valid electrocortical indicators of pain from previous research (Brom, 1984, 1989, 1995). Also, the authors noted the Spiegel and Barabasz (1988) study as a basis for investigating P3 peak amplitude of the SERPs. P3 peaks are the positive ongoing EEG event related potentials occurring about 300 msec after stimulus administration. Finally, the authors also reported a cogent rationale for phasic heart rate, since the PHR is a sensitive index for detecting differential responses to enjoyable and painful stimuli (Palomba et al., 1994, 1997). In conclusion,

the authors did an exceptional job covering relevant theoretical frameworks and important previous research.

Participants took part in 5 treatment conditions: (a) awake; (b), deep relaxation with suggestions of analgesia; (c), dissociation imagery; (d), focused analgesia; and (e) placebo. The results of the study demonstrated the focused analgesia condition obtained the greatest reduction in pain rating, more for the high than low hypnotizables. The N2 amplitude was larger over frontal and temporal scalp sites than over parietal and central sites for high hypnotizables. P3 amplitude was smaller in the deep relaxation, dissociative imagery and focused analgesia in the high hypnotizables over frontal and temporal sites although the greatest reduction was observed in the dissociated imagery and focused analgesia conditions. Finally, skin conductance and PHR was smaller during hypnosis than in waking state.

Identical to De Pascalis et al. (1999), limitations of the DePascalis et al. (2001) experiment include established pain thresholds using two separate 20 point continuous scales that report no face validity and no rationale provided. Therefore, the provision of a reliable and valid measure to establish pain thresholds would be advisable for future research. Another limitation is the lack of provided rationale as to why electrical stimulation is used. Similarly, the lack of provided rationale establishes the necessity to determine electrical stimulation as a verified viable means to induce experimental pain. Also, another limitation is that the authors provide no rationale regarding why frequently occurring stimuli was used in their analyses. Finally, the last limitation of the current study is the remarkable lack of detail regarding the specific suggestions in the hypnosis conditions, which makes replication difficult.

Thus, in summary, this study supports the concept that hypnotic analgesia is a dynamic process, which requires inhibitory processing of incoming painful electrical stimulation. Although there are a few methodological limitations of the study, it is clear that modulation of pain produced by electrical stimulation is primarily limited to high hypnotizables as it is for ischemic pain or cold pressor pain.

DePascalis, Chiaradia, and Carotenuto (2002) reported the production of placebo analgesia by covert reductions in the intensity of electrical stimulation. The study demonstrated that placebo analgesia responses to a placebo "analgesic cream" could be predicted from a sensory suggestibility scale, SSS (Gheorghiu, Koch, and Hubner, 1995). This study examined hypnotizability, verbal expectancy, and concurrent and remembered pain intensity on placebo analgesia. DePascalis et al. (2002) covered relevant theoretical frameworks, detailed previous research, and overall the study was well designed with appropriate methods and analyses.

An electric simulator triggered by a personal computer provided fifteen train pulses that evoked phasic pain by pulses of a constant current intensity. Each train was of 60ms duration and comprised of three biphasic pulses, which were each 1ms in duration. The interpulse interval was 20 msec and the inter train interval was of 15 seconds. The participant's task was to count the delivered stimuli. Two pure tin electrodes 1cm in diameter were used and were affixed using an elastic 'velcro' strap. One electrode was placed over the volar surface of the medial phalange while the other was over the volar surface of the distal phalange. Two pulse stimulation intensities were made for each participant. One pulse was the current intensity corresponding to the

subjective pain intolerability threshold while the other was 70% of the first. The average current intensity value across all subjects was of 5.8+- 1.1 mA.

This study included 72 right-handed undergraduate student participants, which was sufficient for each condition to contain twelve participants, necessary to provide sufficient statistical power. DePascalis et al. (2002) selected participants with the SSS, which is a limitation of the study as a more appropriate measure of hypnotizability such as the SHSS:C (Weitzenhoffer et al., 1962) would have been consistent with hypnosis literature. The most significant limitation is the application of the tin electrodes affixed using an elastic 'velcro' strap. The limitation of the Velcro strap is that movement and other factors can vary the amount of electrical contact over the intended area, even so, at the same set intensity level the subjects may report different levels of stimulation. This limitation can be precluded through use of a TENS type electrode which will be used in the proposed study. Another limitation is the lack of specificity in instructions to participants to induce high and low expectancy for drug efficacy and the subsequent inability to determine the moderator effects of these instructions to induce valid expectancies for drug efficacy. The authors used a 3x2x2x3 MANOVA design, which was appropriate to prevent a Type I error but failed to provide a rationale for incorporation of Wilks Lambda to examine significant effects.

Results of the study had a number of noteworthy effects. First, pairing of covertly decreased pain stimulus intensity in conjunction with placebo produced placebo analgesia such that as intensity was subtly reduced participants believed it to be a function of the placebo "cream" at work, causing placebo analgesia in high hypnotizables even after pain stimulus intensity was increased. Second, verbal expectancy affected overall placebo

analgesia and accounted for large portions of the variance in sensory pain ratings. Third, significant pain intensity reductions were found in “highly suggestible” (p.400) participants receiving “suggestions” intended to obtain high expectancy of drug efficacy and, to a lesser extent, in “mid suggestible” (p.400) participants. Fourth, placebo effects obtained by ratings of remembered pain intensity and unpleasantness were more than twice as large as concurrent placebo effects obtained during painful stimulation trials. Fifth, ratings of remembered pain were associated with expectancy ratings. In summary, the results of the study suggest multiple factors contribute to the placebo effect, including hypnotizability, expectancy/conditioning, and that evaluation of placebo analgesia is obtained depending if pain relief is assessed after treatment or concurrently.

DePascalis, Cacace, and Massicolle (2004) examined the relationship between phase-ordered gamma patterns and pain during hypnosis through analysis of somatosensory event-related phase-ordered gamma oscillations to electric painful standard stimuli under an odd-ball paradigm in 13 high, 13 medium, and 12 low hypnotizable participants during waking, hypnosis, and post-hypnosis conditions. Participants were assigned to the high hypnotizable group (N = 13, M = 9.9, SD = .86) when their score on the SHSS: C was one standard deviation above the group mean (N = 78, M = 6.0, SD = 2.96). Similarly, participants assigned to the low hypnotizable group (N = 12, M = 2.8, SD = 1.47) when their score was one standard deviation below the group mean. Participants were assigned the mid hypnotizable group (N = 13, M = 6.1, SD = 0.9) when their score was within one standard deviation of the group mean.

Electric pulse stimulation consisted of 70 electric stimuli for each condition via the oddball paradigm in which infrequent targets occur 14.5% and standard targets occur

85.5% of the time. The inter stimulus interval, ISI was set at three seconds while each standard target was comprised of one unipolar pulse lasting two milliseconds and the interpulse interval was twenty five milliseconds. No rationale was provided for why electrical stimulation is the experimentally induced pain of choice for the study. The electric stimuli was administered to the middle finger of the right hand in five conditions: (a) waking pain (no suggestions), (b) waking analgesia (suggestions for relaxation and attenuated sensations of the finger and hand), (c) hypnosis-pain (eyes closed, induced hypnosis, no relaxation or attenuated sensations of the finger and hand suggestions), (d) hypnosis-analgesia (eyes closed, hypnosis induction, focused analgesia suggestions), and (e) a post post-hypnosis analgesia (after hypnosis, hypnosis is induced again with eyes open and suggestions of focused analgesia given).

One limitation of the study is that the authors utilize the NRS, or numerical rating scale for the participants to rate their pain and distress experience without noting its reliability, validity, or rationale. The NRS creates a non-linear measurement due to limiting response to painful stimuli at 10 while an open-ended scale is more desirable and useful for pain ratings in pain studies. Another limitation of the study is the lack of detail regarding the specific suggestions in the hypnosis conditions, which makes replication difficult.

High hypnotizables demonstrated the greatest effect such that, compared to medium and low hypnotizables, highs had significant pain and distress reductions for the focused analgesia in hypnosis and, to a larger degree, during the post hypnosis condition. High and medium hypnotizables demonstrated a significant reduction in their gamma patterns for focused analgesia during hypnosis and post hypnosis conditions although this

reduction was most notable in the high hypnotizable participants. Gamma oscillations occur in the 38-42 Hz range and are generally recognized to play a critical role in information processing (DePascalis et al., 2004). 'Evoked' gamma activity is researched the most and has led to the tentative conclusion that synchronized gamma activity may also play a role in selective attention (DePascalis et al., 2004). Reductions in gamma patterns coincided with significant reduction in pain and distress ratings. The gamma scores on the central scalp site predicted participant pain ratings for the waking-pain and waking analgesia conditions, although the frontal scalp site was most appropriate for predicting pain rating during post hypnosis analgesia conditions. Thus, it appears that hypnosis interferes with phase ordered gamma oscillations and the perception of pain produced by electric stimuli, possibly through a suspension of a higher order attentional system.

The DePascalis and Cacace (2005) study was similar to DePascalis et al. (2004) study, although the later study proposed to look more closely at the neural mechanisms underlying pain perception and anti-nociceptive effects of mental imagery. Participants consisted of 40 right-handed undergraduate students (20 women, 20 men aged 19-30 years old) who were asked to count the number of painful electric stimuli. Two treatment conditions were present: a pain condition (experimentally induced painful electrical stimulation) and an obstructive imagery for pain reduction condition. The electric pulse stimulation used for the experimental conditions replicated DePascalis et al. (2004) exactly.

There are a number of limitations in this study. First, the authors utilize the NRS, or numerical rating scale for the participants to rate their pain and distress experience

without noting its reliability, validity, or rationale. The NRS creates a non-linear measurement due to limiting response to painful stimuli at 10 while an open-ended scale is more desirable and useful for pain ratings in pain studies (Hilgard et al., 1994). Second, the lack of detail regarding the specific hypnotic suggestions for the experimental conditions makes replication difficult. Third, no rationale for electric pulse stimulation is given. Fourth, no rationale is provided for how participants were to be put into the two treatment conditions. Finally, since hypnosis was not induced in the obstructive imagery condition, the authors assumption that the "relationship between pain sensation and gamma synchrony may be modulated by hypnotizability" is seemingly supported; however, the possibility of spontaneous hypnosis (see Barabasz, 2005/2006) in the obstructive imagery condition for high hypnotizables was not controlled for, thus, firm support for the use of obstructive imagery in the hypnosis literature for pain modulation would be supported to a greater degree if spontaneous hypnosis was controlled for.

The authors analyzed beta and gamma bands of interest and found that obstructive imagery, compared to the pain condition, provided significant reduction of pain perception and go on to state that pain reduction during obstructive mental imagery (without hypnosis induction) may be the product of an inhibitory process that involves frontal and parietal cortical regions. In conclusion, the authors found that phase ordered gamma oscillations recorded over the central scalp sites were related to the subjective experience of pain. In sum, DePascalis et al. (2005) study had significant findings and notably contributes to the body of academic research.

Summary of Ischemic Finding Relevant to Current Study

The Barabasz and Barabasz (1989) study demonstrates REST's effectiveness in a clinical context by discernibly bridging the gap between experimental hypnosis pain management results and pain management results in the clinical arena. Also, this study significantly adds to the hypnosis literature because of a notable lack of such similar studies.

DeBenedittis, Panerai, and Villamira (1989) significantly added to the hypnosis literature by demonstrating that hypnosis does significantly much more than placebo to reduce pain perception. Further, it provided evidence that pain and distress reductions are positively related to hypnotizability, and that high hypnotizables reduce distress more than pain. Finally, it demonstrated hypnotic analgesic effects upon pain reduction are unrelated to anxiety reduction.

Knox et al. (1974) suggested "hidden" reports of pain and suffering during hypnotic analgesia, obtained through automatic talking, revealed few differences in their "hidden" report from participants in hypnosis without analgesic suggestions. Notably, the possibility of two cognitive systems from the Gate Control Theory emerged (sensory discriminative pain system and motivational affective pain system), which are processing information at dissociated levels of awareness. Finally, the study demonstrated that the presence of the hidden observer casts no doubt on the clinical effectiveness of hypnosis in pain reduction.

McGlashan et al.'s (1969) landmark study on the effect of placebo in relation to hypnotizability demonstrated that only the high hypnotizables produced significant reduced pain reports when exposed to hypnosis but that the lows were unable to do so in

the identical condition. This study showed definitively that hypnotic reductions in pain are due specifically to hypnosis and that hypnosis does significantly more than placebo.

Summary of Electrical Stimulation Findings Relevant to Current Study

Barabasz' (1982) experimentally controlled study demonstrated significant effects which contributed to hypnosis literature on the modifiability of hypnotic responsiveness and to the effects of hypnosis on pain management using electrical stimulation. The hypnosis research of DePascalis in the use of electrical stimulation provides a number of significant findings relevant to the current study. The DePascalis et al. (1999) study was also fully controlled and utilized far more sophisticated equipment as a result of technological advances to experimentally induce pain through electrical stimulation than in methods in studies appearing nearly two decades earlier (i.e. Barabasz, 1982). This study supported the validity of electrical stimulation use at the construct level given the corroboration of physiological measures. The DePascalis et al. (2001) study supported the concept that hypnotic analgesia is a dynamic process, which requires inhibitory processing of incoming painful electrical stimulation. Although there are a few methodological limitations of the study, it is clear that modulation of pain produced by electrical stimulation is primarily limited to high hypnotizables, as it is for ischemic pain or cold pressor pain.

Significant findings in DePascalis et al. (2002) suggests multiple factors contribute to the placebo effect, including hypnotizability, expectancy/conditioning, and that evaluation of placebo analgesia is obtained depending if pain relief is assessed after treatment or concurrently. The relevant significant findings of the DePascalis et al. (2004) study suggests that hypnosis interferes with phase ordered gamma oscillations and

the perception of pain produced by electric stimuli, possibly through a suspension of a higher order attentional system. Finally, DePascalis et al. (2005) study found that phase ordered gamma oscillations recorded over the central scalp sites were significantly related to the subjective experience of pain. Thus the use of electrical stimulation as a viable method of inducing pain is established, psychophysiological correlates have been established with the use of electrical stimulation, and a number of important methodological considerations relevant to the current study are noted for consideration.

Therefore, the progression of research has led to the need to experimentally evaluate and compare experimentally induced TENS pain with ischemic pain in hypnosis research to determine if TENS pain also approximates clinical pain like ischemic pain.

CHAPTER THREE

Participants

University volunteers were recruited through classroom solicitations, campus flyers, and advertisements in the college newspaper. The final sample was comprised of 50 participants with all participants experiencing each of two pain conditions (ischemic and TENS). Participants were all over 18 years old and did not report a history of psychological disorders and did not report ingesting psychoactive or pain medication (either prescribed or recreational). Other factors precluding participation were medical conditions that might modulate pain perception (e.g., high blood pressure, diabetes mellitus, including conditions such as tachachardia, asthma, Raynaud's syndrome, frostbite, and arthritis).

The final sample was comprised of 50 participants with all participants in each of the pain conditions. Thirty-nine participants were female, 11 were male, age range was from 20-65 years old, the median age was 39 years old, the mean age was 41 years old, and the ethnicity of the sample was comprised of 5 participants of Asian ethnicity, 8 participants of Latino ethnicity, and 37 participants of Caucasian ethnicity.

Experimenter

The experimenter was one graduate student who had at least 60 hours of experience and training in hypnosis (100-150 inductions).

Instruments

The Stanford Hypnotic Clinical Scale (Morgan and Hilgard, 1975), is a valid and widely used instrument for measuring hypnotic responsiveness. Five items comprise the SHCS which are derived from the items already well established within the Stanford Hypnotic Susceptibility Scales, Forms A, B, and C (Weitzenhoffer and Hilgard, 1959;

1962). The items are (a) moving hands (a motor item intended to introduce the participant to suggestion); (b) a hypnotically induced dream; (c) age regression (which is commonly used in therapy); (d) a posthypnotic suggestion (continuation of the hypnotic experience); and (e) posthypnotic amnesia (which may be useful in relation to forgetting the experience of pain). The SHCS was standardized on a group of 111 undergraduate students with half the participants taking the SHCS first and half taking the SHSS: C first. Means for males and females were not significantly different and the average score was 2.75 such that half the participants did perform more than two of the total five items, but less than three. The test-retest reliability estimate for the SHCS is .72. The correlation between the four common items between the SHCS and the SHSS: C is .81. Therefore, the SHCS can be regarded as a reliable and valid measure of hypnotic responsiveness given the well established standardized reliability and validity of the SHSS: C in diverse populations (Barabasz & Barabasz, 1992; Barabasz & Watkins, 2005). The SHCS was used to describe the range of hypnotizability for all participants. Also, the SHCS helped to determine whether or not hypnotizability was related to pain reports in each experimental pain condition.

A questionnaire of clinical pain experiences was employed for the primary purposes of this study. Each participant, after experiencing the pain condition was asked, "How closely does [TENS or ischemic] pain approximate clinical pain?" on a 7 point semantic differential scale with 1=no approximation to clinical pain, 7= complete approximation to clinical pain. (Osgood, Suci, & Taunenbaum,1950). Other questions in the questionnaire asked the participant in an open-ended fashion, "Tell me the most significant or worst experience of pain you have ever experienced." Also participants

were asked if they had experienced chronic pain and if they had, to please describe and explain. Finally, participants who had experienced chronic pain were asked whether they implemented pain management strategies. Post experimental inquiry was used for all participants to determine if pain management strategies were employed as a function of order effects.

Apparatus

A portable TENS unit (RELIAMED 350, ZZ350) was used. The device allows adjustable pulse rate, pulse width, and amplitude (intensity) to be used. The pulse amplitude (intensity) pain setting used in the present study was determined by running 4 volunteers including two dissertation committee members and this experimenter through a variety of settings. The level chosen was the first setting that produced an involuntary contraction of the extensor muscles in the hand (the hand straightens out uncontrollably) for each participant and was perceived by each as "about an 8" out of 10 where 1 = no pain perception and 10= the point that one would very much like to have the current turned off. Dual, isolated channels provide an asymmetrical biphasic output, with adjustable pulse amplitude and pulse rate. There are three modes of operation: conventional, burst or modulation. Conventional operation uses regular alternating pulses between the two electrodes and was the mode of operation utilized for this experiment. Physical description includes size of 24 x 64 x 95 mm; weight of 130 grams including battery; insulated caps over operational buttons; a resilient plastic case; and a 9-volt alkaline battery for power. The technical specifications includes: dual channels isolated between each other, a modified square wave form with zero net (DC) component, a pulse amplitude from 0 to 80MA for each channel that is adjustable to a

maximum 500ohm load, an adjustable pulse frequency from 2 to 150 Hz, an adjustable pulse width from 60 to 250 microseconds that modulates, a pulse mode width that automatically varies in a cyclic pattern over an interval of nominally 4.0 seconds and burst mode of 7 pulses per burst (2 bursts per second) with an internal burst frequency of 100 Hz, a maximum voltage of 100 volts on an open circuit, and finally a maximum charge of 16 microcoulombs per pulse.

Procedure

First, volunteers answered a telephone questionnaire to prescreen participants in order to eliminate volunteers not suitable to hypnosis or pain perception. Second, written informed consent was obtained at the initial face-to-face session according to standard IRB guidelines. Third, participants were introduced to hypnosis to help maximize hypnotic performance. Myths were debunked, followed by a lecture and demonstration on hypnosis. Fourth, participants were alternately assigned to 1st order (ischemia awake followed by TENS in hypnosis) or 2nd order (TENS awake followed by ischemia in hypnosis) of pain conditions and hypnosis to eliminate any potential confounds from order effects. Fifth, participants filled out a questionnaire about their experience of pain. Sixth, upon completion of each experimental pain procedure each participant was asked to rate the experimental pain in regards to how it approximated clinical pain using the semantic differential (1= doesn't approximate clinical pain, 7 = complete approximation of clinical pain). These semantic differential perceived pain ratings were used in the statistical analyses. Seventh, and last, a post-experimental inquiry was conducted to determine if participants used any pain management techniques (especially participants

with chronic pain) including hypnosis to deal with the experimental pain in the awake condition.

In the 1st order condition (ischemia awake followed by TENS in hypnosis) participants underwent the pain condition in a waking state with no suggestion and subsequently were asked by the experimenter to rate how the perceived pain approximated clinical pain using the semantic differential. Next, hypnosis was induced using the Stanford Hypnotic Clinical Scale. While remaining in hypnosis and in order to maximize effectiveness the DePascalis et al. (2001) hypnotic analgesia suggestion was chosen; "suggestion to focus on sensations in the hand and arm and to experience that all the sensations of the stimulated arm will be attenuated 'as if it was a glove' that was covering the hand and wrist." Subsequently, participants underwent the TENS pain condition and were asked by the experimenter to rate how the perceived pain approximated clinical pain, again using the semantic differential. In the 2nd order (TENS awake followed by ischemia in hypnosis), the same procedure was followed as in 1st order except for the order of experimental pain administered.

Each participant, when undergoing ischemic pain, had his/her arm raised toward the ceiling and a bandage wrapped around the arm to increase venous drainage prior to inflating the sphygmomanometer cuff which was placed above the elbow to 240 mmHG. The arm was lowered and a hand dynamometer (set to 8 Kg) put in the participant's hand. The participant was instructed to squeeze and release the dynamometer 20 times to accelerate the process of ischemic pain. Each squeeze and rest cycle lasted for 2 seconds. Participants squeezed the dynamometer 20 times followed by a 90 second period prior to obtaining pain reports. Consistent with Hilgards submaximal pain rating procedure,

perceived pain ratings were provided every five seconds for 90 seconds. Participants were asked to rate their pain from 0 to 10 where 10 is the point at which they would very much like to have the cuff taken off but allow for ratings to continue beyond 10.

For each participant undergoing TENS pain the hand was carefully cleansed with an alcohol swab and electrodes applied in an exact fashion, below the knuckles, a half inch apart, across the anterior surface of the hand covering the bones of the 2nd through 5th phalanges. Subsequently the device was turned on, and the dial turned up at steady rate of ½ notch per second while the experimenter asked for a pain rating at each half point on the dial. Again, consistent with Hilgards submaximal pain rating procedure, perceived pain ratings were provided at each ½ notch of the dial. Participants were asked to rate their pain from 0 to 10 where 10 is the point at which they would very much like to have the TENS machine turned off but allow for ratings to continue beyond 10.

Analysis:

For the hypothesis non-parametric statistics employing the Mann Whitney U test was used to compare the: (a) Awake condition with TENS and ischemia and (b) Hypnosis condition with TENS and ischemia for semantic differential perceived pain ratings. For linear report data parametric statistics employing ANOVA's was used to compare (a) Awake condition with TENS and ischemia and (b) Hypnosis condition with TENS and ischemia (c) Awake versus Hypnosis conditions with TENS and (d) Awake versus Hypnosis conditions with ischemia. For the research question regarding high hypnotizables ability to manage pain for TENS and ischemic conditions, non-parametric statistic employing the Mann Whitney U test was used.

CHAPTER FOUR

The main hypothesis of this study predicted that in contrast to ishcemic pain, electrically induced TENS pain would produce ratings of pain perception that are significantly more similar to actual pain responses as measured by semantic differential reports (accident and medical pains previously experienced by each participant) ($p<.05$). Additionally, the research question was posited, Do high hypnotizables differ in their ability to manage pain induced by electrical stimulation as compared to ischemic pain as measured by semantic differential reports? The experimenter planned to use ANOVAs, but the semantic differential data did not meet the assumption of normality so the non-parametric Man Whitney U test analyses were conducted. However, for the linear pain report data ANOVA's were employed as this data met the assumptions of normality. For further reference the parametric test results for the semantic differential are included in Appendix A for interest.

The statistical software package utilized for the current analyses was Graph Pad InStat 3 from GraphPad Software. GraphPad statistical software packages were initially designed and written in 1984 and have had many subsequent versions. The writer and developer, Dr. Harvey Motulsky, is a faculty member at the University of California San Diego and teaches medical and graduate students courses in intuitive biostatistics.

For this experiment the non-parametric test chosen was the Mann Whitney U test for the two non-normal distributions with independent selection. This test is referenced in Nonparametric Statistics for Behavioral Sciences (Siegel & Castellan, 1988). For interest, means, standard deviations, and data points are shown in table 1.

Table 1

Semantic Differential Means and Standard Deviations for all Conditions

Group	Number of Data Points	Mean	Standard Deviation
Tens Hypnosis	24	5.8541	1.4260
Ischemic Hypnosis	26	4.6923	2.1590
Awake Tens	26	5.2885	1.4295
Awake Ischemic	24	4.5417	1.9444

To test the hypothesis that in contrast to ischemic pain, electrically induced TENS pain would produce ratings of pain perception that are significantly more similar to actual pain responses as measured by semantic differential reports (accident and medical pains previously experienced by each participant) ($p<.05$), Mann Whitney U analyses were conducted. The test revealed no significant differences for semantic differential reports between TENS and ischemic pain in the Awake condition. Contrary to the hypothesis, the sum of the average ranks for experimental TENS pain, was not significantly higher (M rank = 28.04, n=26) than the sum of the average ranks for experimental ischemic pain (M rank = 22.75, n=24) $z(50) = -1.298$, $p=.194$, thus the difference between group mean ranks (Awake TENS vs. awake ischemia) is not significantly greater than expected by chance alone. A detailed summary of the Mann Whitney U test for the awake condition appears in table 2:

Table 2

Mann Whitney U Test Results for the Awake Condition

Group	Number of Points	Sum of Ranks	Mean of Ranks
Tens	26	729.00	28.04
Ischemic	24	546.00	22.75

To complete analyses for the hypothesis, Mann Whitney U analyses were conducted. The test revealed significant differences for semantic differential reports between TENS and ischemic pain in the Hypnosis condition. Contrary to the hypothesis, the sum of the average ranks for experimental TENS pain, was significantly higher (M rank = 30.60, n=26) than the sum of the average ranks for experimental ischemic pain (M rank = 20.79, n=24) z(50) = -2.416, p=.016, thus the difference between group mean ranks (Hypnosis TENS vs. Hypnosis ischemia) is significantly greater than expected by chance alone. A detailed summary of the Mann Whitney U test for the hypnosis condition appears in table 3:

Table 3

Mann Whitney U Test Results for Hypnosis Condition

Group	Number of Points	Sum of Ranks	Mean of Ranks
Tens	26	734.50	30.60
Ischemic	24	540.50	20.79

To complement the analyses for the hypothesis, ANOVA's were conducted on the linear pain report data. The test revealed significant differences for linear pain reports between TENS versus ischemia in the awake condition. The results for the awake condition revealed TENS to be significantly higher ($M = 12.269$, $n = 26$, $SD = 4.600$) than ischemia ($M = 8.354$, $n=24$, $SD = 2.199$) $df(48) = 14.399$, $p<.0001$, thus the difference between TENS vs. ischemia) is significantly greater than expected by chance alone. A detailed summary of the means, standard deviations, and standard error of the mean appears in table 4. A detailed summary of the ANVOA test for the TENS vs. ischemia in the awake condition appears in table 5:

Table 4

Linear Pain Reports Means, Standard Deviations, and SEM for TENS vs Ischemia in the Awake Condition

Group	Data Points	Mean	Standard Deviation	SEM
TENS	26	12.269	4.600	0.902
Ischemia	24	8.354	2.199	0.448

Table 5

Linear Pain Reports ANOVA Results for the TENS vs. Ischemia in the Awake Condition

Group	SS	df	MS	F	significance
Between	191.290	1	191.290	14.339	$p < .0001$
Within	640.355	48	13.341		

To complement the analyses for the hypothesis, ANOVA's were conducted on the linear pain report data. The test revealed significant differences for linear pain reports between TENS versus ischemia in the hypnosis condition. The results for the hypnosis condition revealed TENS to be not be significantly higher ($M = 8.020$, $n = 24$, $SD = 2.040$) than ischemia ($M = 6.480$, $n=26$, $SD = 3.302$) $df(48) = 3.856$, $p=.055$, thus the difference between TENS vs. ischemia in the hypnosis condition was not significant. A detailed summary of the means, standard deviations, and standard error of the mean appears in table 6. A detailed summary of the ANVOA test for the TENS vs. ischemia in the hypnosis condition appears in table 7:

Table 6

Linear Pain Reports Means, Standard Deviations, and SEM for TENS vs Ischemia in the Hypnosis Condition

Group	Data Points	Mean	Standard Deviation	SEM
TENS	24	8.020	2.040	0.416
Ischemia	26	6.480	3.302	0.647

Table 7

Linear Pain Reports ANOVA Results for the TENS vs. Ischemia in the Hypnosis Condition

Group	SS	df	MS	F	significance
Between	29.600	1	29.600	3.856	p=.055
Within	368.480	48	7.677		

In order to answer the research question: Do high hypnotizables differ in their ability to manage pain as measured by semantic differential reports whether induced by electrical stimulation as compared to ischemic pain? Mann Whitney U analyses were conducted. High hypnotizables were participants with scores of 4-5 on the Stanford Hypnotic Clinical Scale (SHCS) while low hypnotizables were participants with scores of 0-1 on the SHCS. For interest, the means, standard deviations, and data points are presented in Table 8.

Table 8

Means and SD's for High Hypnotizables for TENS and Ischemia in Hypnosis Condition

Group	Number of Data Points	Mean	Standard Deviation
High Hypnotizable Tens	4	6.75	0.500
High Hypnotizable Ischemic	4	2.75	2.363

Although not included in the analysis, it seemed worthwhile to report that the TENS low hypnotizable scores were heavily weighted toward the higher end of the semantic differential report scale. The relatively small sample size and non-normal distributions limit analyses to the nonparametric domain.

Mann Whitney U analyses revealed a significant difference for the semantic differential reports for the high hypnotizables between TENS and ischemic conditions. The sum of the average ranks for experimental TENS pain, was significantly higher (M rank = 25.50, n=4) than the sum of the average ranks for experimental ischemic pain (M rank = 10.50, n=4), U(8) =.500, p=.029, thus the difference between group mean ranks (High hypnotizable TENS vs. high hypnotizable ischemia) is significantly greater than expected by chance alone. A detailed summary of the Mann Whitney U test for the high hypnotizables for TENS and ischemic condition appears in table 9:

Table 9

Mann Whitney U Test Results for High Hypnotizables

Group	Number of Points	Sum of Ranks	Mean of Ranks
Ischemic Highs	4	10.50	10.50
Tens Highs	4	6.38	25.50

To complement the analyses for the research question, ANOVA's were conducted on the linear pain report data. The test revealed significant differences for linear pain reports between awake and hypnosis conditions with ischemic pain. Consistent with previous research, the results for hypnosis condition, was significantly lower (M = 6.480, n = 26, SD = 3.3029) than the results for the awake condition (M = 8.354, n=24, SD = 2.1992) df(48) = 5.475, p=.023, thus the difference between groups (Hypnosis vs. Awake Ischemia) is significantly greater than expected by chance alone. A detailed summary of the means, standard deviations, and standard error of the mean appears in table 10. A detailed summary of the ANVOA test for the hypnosis vs. awake condition appears in table 11:

Table 10

Linear Pain Reports Means, Standard Deviations, and SEM for Awake vs Hypnosis in Ischemia

Group	Data Points	Mean	Standard Deviation	SEM
Awake	24	8.354	2.1992	0.448
Hypnosis	26	6.480	3.3029	0.647

Table 11

Linear Pain Reports ANOVA Results for the Awake vs. Hypnosis Condition in Ischemia

Group	SS	df	MS	F	significance
Between	43.800	1	43.800	5.475	0.023
Within	383.980	48	8.000		

To complement the analyses for the research question, ANOVA's were conducted on the linear pain report data. The test revealed significant differences for linear pain reports between awake and hypnosis conditions with TENS pain. Consistent with previous research, the results for hypnosis condition, was significantly lower ($M = 8.028$, $n = 24$, $SD = 2.040$) than the results for the awake condition ($M = 12.269$, $n=26$, $SD = 4.600$) $df(48) = 17.303$, $p<.0001$, thus the difference between groups (Hypnosis vs. Awake TENS) is significantly greater than expected by chance alone. A detailed summary of the means, standard deviations, and standard error of the mean appears in table 12. A detailed summary of the ANVOA test for the hypnosis vs. awake condition appears in table 13:

Table 12

Linear Pain Reports Means, Standard Deviations, and SEM for Awake vs Hypnosis in TENS

Group	Data Points	Mean	Standard Deviation	SEM
Awake	26	12.269	4.600	0.902
Hypnosis	24	8.028	2.040	0.416

Table 13

Linear Pain Reports ANOVA Results for the Awake vs. Hypnosis Condition in TENS

Group	SS	df	MS	F	significance
Between	225.250	1	225.250	17.303	0.0001
Within	624.855	48	13.018		

The post-experimental inquiry was conducted to determine if participants used any pain management techniques (especially participants with chronic pain) including hypnosis to deal with the pain condition in the awake condition. There were eight patients who experienced chronic pain, three of whom reported employing the pain management technique of "hypnosis" to dissociate from their pain in awake condition (2 in ischemia, 1 in TENS); these participants reported no other pain management techniques. Participants who did not experience chronic pain totaled 42, of which two employed pain management techniques of positive self talk during the awake conditions but not during the hypnosis condition (e.g. – "This won't last that long"). Childbirth (24/39 female participants), followed by back pain (19/50 participants), followed by broken bones (7/50 participants) were the pains most experienced that participants were comparing experimental pain to.

Interestingly, the most often heard comment regarding pain management techniques for the TENS awake condition was "There was no way at all to manage the TENS pain because I had no control" (14/25 participants). Spontaneous TENS comments included, "It felt like a localized charley horse, it felt like when you hit your funny bone, and like the fastest pain ever." The most often heard comment for ischemic pain management was, "I could manage the ischemic pain because it built up more slowly over time" (3/25). Spontaneous ischemic comments included "Feels like my hand and arm aren't attached and like when my foot goes to sleep only much worse." Finally, eight participants in the ischemic condition while in hypnosis spontaneously commented that they felt the glove suggestion was extremely effective.

CHAPTER FIVE

This was the first investigation to demonstrate that transcutaneous electrical nerve stimulation (TENS) could serve as a statistically valid experimental pain procedure in addition to ischemia in hypnosis pain research. Furthermore, existing research findings utilizing TENS as a means to approximate clinical pain in research may be further validated and future research may opt for TENS pain with a viable rationale because it is faster and has fewer methodological limitations than ischemic pain. Findings are discussed in this chapter as they relate to conclusions, limitations, and suggestions for further research.

The primary purpose of the present study was to compare experimentally induced ischemic pain and pain induced by electrical stimulation (TENS) employing current instrumentation and methodology. According to findings of the present study, TENS pain, as compared with ischemic pain, produced ratings of pain perception not significantly more similar to actual pain response in the awake state (it was different in hypnosis state) when rating pain with a semantic differential perceived pain rating. However, the opposite was found when rating pain with linear pain reports. It was expected that since technology had changed the way in which electrical stimulation could be applied it might prove useful to allow for another viable experimental pain method. This was expected, in part, due to the research done by DePascalis at the University of Rome, where he was having success using TENS as an experimental pain procedure in hypnosis research studying psychophysiological correlates.

Surprisingly, the TENS condition garnered high pain ratings across both waking and hypnotic conditions most notably for semantic differential pain ratings but also for linear pain reports. Thus, TENS appears to approximate pain more closely than ischemia

when using linear pain reporting rating regardless of condition (Awake vs Hypnosis) whereas when using semantic differential pain rating a significant difference was only observed in the hypnosis condition but not for the awake condition. Upon closer examination of the data and the post-experimental inquiry, however, it may be inferred that the TENS pain was rated higher because of the more rapid onset of perceived pain and the sense of total loss of control as compared with the mounting pain over a longer period and allowing time to prepare for increasing pain, as in the case of ischemic pain. During administration TENS pain ratings were linear, rising to much higher values than ischemic pain rating, which were linear, but had much lower ratings. Also, in the TENS hypnosis condition anecdotal participant feedback provided comments akin to "Because I was relaxed and totally focused I rated pain higher because all my attention was on it."

Participant feedback generally reported feeling the TENS pain to be more consistent with an acute pain as suffered in an accident due to the relatively transitory nature of its experience, whereas ischemic pain was more like a chronic pain due to the continued nature of its experience. Thus, Hilgard's (1991) hypothesis faces contradictory evidence of ischemic pain's superiority over electrical stimulation. Instead it would appear they are equal, or perhaps it may be tentatively inferred that, more precisely, the two types of experimental pains approximate acute and chronic pain more than a generic clinical pain that may not, by common definition, necessarily be acute or chronic in its nature. Therefore, the present study shows that electrically induced TENS pain does not produce ratings of pain perception that are significantly more similar to actual pain perception when participants rated with the semantic differential perceived pain rating.

The research question of interest was to determine if high hypnotizables differ in their ability to manage pain induced by electrical stimulation as compared to ischemic pain. This was found to be true in the present study, as high hypnotizables did differ in their ability to manage pain induced by TENS as compared to ischemia ($p<.05$). In fact, the mean rank difference of 15.000 was found between the high hypnotizable TENS and high hypnotizable ischemic groups.

Interestingly, there were remarkably little semantic differential perceived pain ratings in TENS regardless of awake or hypnosis conditions. In other words, it was expected that hypnotizability would play a role in mediating TENS pain. This is evidenced in the pain ratings for TENS in high and low hypnotizables being actually quite similar, perhaps again lending some credence to the uncontrollable nature and unmanageability of the TENS pain referred to in the post experimental inquiry. Thus, Orne's conceptualization that "you have to feel it not to feel it" may be at work. It may be possible that the onset of TENS pain is so quick that high hypnotizability could not allow for a significant reduction in pain.

However, while these results for the semantic differential yielded little difference amongst hypnosis or awake conditions, when employing the linear pain reports the findings were quite different. Rather, participant linear pain reports were significantly greater in the awake condition for TENS and ischemia with TENS having the higher result. Thus, this may be tentative evidence in support of the fact that TENS approximates clinical pain more accurately than ischemia. Also, there was no significant difference between the linear pain report scores for TENS and ischemia in the hypnosis condition.

In comparing the awake versus hypnosis conditions across experimental pains, hypnosis significantly reduced linear pain reports for both TENs and ischemia. Thus, in answer to the research question of interest, yes, high hynotizables appear to differ in their ability to manage pain induced by electrical stimulation as compared to ischemic pain when providing rating with a semantic differential. However, the small sample size, especially among the high hypnotizable groups confounds the research question and warrants serious tentativeness in generalizing and interpreting these results.

Limitations in the current study begin from the point of view of traditional research designs such that the current investigation was limited by the experimental nature involving a convenience sample and a small sample size for high and low hypnotizables. It is also possible that the perceived pain ratings were affected by a participant pool older than the college sophomore pool most often used in general research. Also, the semantic differential pain ratings yielded essentially a uni-modal distribution amongst TENS thus limiting the utility of the analyses when compared to ischemic pain. It is possible that this sample had had more painful experiences over a longer lifetime and may have employed pain management techniques with little conscious awareness. A larger sample size and deepening of the hypnotic state may also be appropriate to maximize the effective of the hypnotic analgesia suggestion for TENS pain. Also, the participants anticipated painful experiences. Further research is needed comparing TENS pain with ischemic pain for acute (broken bone) and chronic conditions (chronic back pain). Specifically, future research focused on comparing high hypnotizables in TENS vs ischemia using the Stanford Hypnotic Susceptibility Scale:

Form C would help to determine more about the degree of possible pain modulation by increased differentiation of high hypnotizables that was not possible with the SHCS.

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Appendix A

Parametric Tests for Semantic Differential

Table 1

Semantic Differential Means, Standard Deviations, and SEM for all Conditions

Group	Data Points	Mean	Standard Deviation	SEM
Tens Hypnosis	24	5.8541	1.4260	0.291
Ischemic Hypnosis	26	4.6923	2.1590	0.432
Awake Tens	26	5.2885	1.4295	0.279
Awake Ischemic	24	4.5417	1.9444	0.434

Table 2 Intermediate calculations Awake & Hypnosis Conditions on Pain Rating

ANOVA Table			
Source of Variation	Df	SS	MS
Between Groups	3	34.226	11.409
Within Groups	96	318.11	2.1590

Table 3

Tukey-Kramer Multiple Comparisons Test: Awake & Hypnosis Conditions on Pain

Comparison	Mean Difference	Q	p value
tens hypnos vs ischem hypnos	1.162	3.189	ns p>.05
tens hypnos vs awake tens	0.777	2.133	ns p>.05
tens hypnos vs awake ischem	1. 625	4.373	* p<.05
ischem hypnos vs awake TENS	-0.384	1.077	ns p>.05
ischem hypnos vs awake hypnos	0.463	1.271	ns p>.05
tens hypnos vs ischem hypnos	0.847	2.327	ns p>.05

Table 4

Semantic Differential Means, Standard Deviations, and SEM for High Hypnotizables

Group	Data Points	Mean	Standard Deviation	SEM
Tens High Hypnosis	4	6.75	0.500	0.250
Ischemic High Hypnosis	4	2.75	2.363	1.181

Table 5 Intermediate calculations: High and Low Hypnotizables Ability to Manage Pain

ANOVA Table			
Source of Variation	Df	SS	MS
Between Groups	3	42.932	14.311
Within Groups	22	63.722	2.896

Table 6

Tukey-Kramer Multiple Comparisons Test: High Hypnotizables Ability to Manage Pain

Comparison	Mean Difference	Q	p value
ischemic high vs isch low	-1.806	2.497	ns p>.05
isch high vs tens high	-4.000	4.701	* p<.05
isch high vs tens low	-3.250	4.494	* p<.05
ischem low vs tens high	-2.194	3.034	ns p>.05
ischem low vs tens low	-1.444	2.546	ns p>.05
tens high vs tens low	0.750	1.037	ns p>.05

Non Parametric Tests for Linear Pain Reports

Table 7

Mann Whitney U test Results for the Awake vs. Hypnosis Condition in TENS

Group	Number of Points	Sum of Ranks	Mean of Ranks
Awake	26	872.50	33.56
Hypnosis	24	402.50	16.77

Table 8

Mann Whitney U test results for Awake vs. Hypnosis Ischemia

Group	Number of Points	Sum of Ranks	Mean of Ranks
Awake	24	726.50	30.27
Hypnosis	26	548.50	21.10

Appendix B

MEMORANDUM

TO: ARREED BARABASZ and Seth Green

FROM: Malathi Jandhyala (for) Kris Miller, Chair, WSU Institutional Review Board (3005)

DATE: 2/29/2008

SUBJECT: Approved Human Subjects New Protocol, IRB Number #10202-001

Your Human Subjects Review Summary Form and additional information provided for the proposal titled "Hypnosis and Pain Relief", IRB File Number 10202-001 was reviewed for the protection of the subjects participating in the study. Based on the information received from you, the WSU-IRB approved your human subjects protocol on 2/29/2008. This protocol is given Expedited review category.

IRB approval indicates that the study protocol as presented in the Human Subjects Form by the investigator, is designed to adequately protect the subjects participating in the study. This approval does not relieve the investigator from the responsibility of providing continuing attention to ethical considerations involved in the utilization of human subjects participating in the study.

This approval expires on 2/26/2009. If any significant changes are made to the study protocol you must notify the IRB before implementation. Request for modification forms are available online at http://www.irb.wsu.edu/forms.asp.

In accordance with federal regulations, this approval letter and a copy of the approved protocol must be kept with any copies of signed consent forms by the principal investigator for THREE years after completion of the project.

Washington State University is covered under Human Subjects Assurance Number FWA00002946 which is on file with the Office for Human Research Protections.

If you have questions, please contact the Institutional Review Board at (509) 335-3668. Any revised materials can be mailed to the Office of Research Assurances (Campus Zip 3005), faxed to (509) 335-6410, or in some cases by electronic mail, to irb@mail.wsu.edu.

Review Type: New Protocol
Review Category: Expedited
Date Received: 1/10/2008
OGRD No.: N/A
Agency: N/A

Thank You,

Institutional Review Board

Malathi Jandhyala
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Office of Research Assurances
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WASHINGTON STATE UNIVERSITY
CONSENT FORM

[Experimental Pain in Hypnosis Research: Ischemic vs Transcuteaneous Electrical Nerve Stimulation (TENS)]

Researchers: Arreed Barabasz, Department of Educational Leadership and Counseling Psychology, Faculty

Seth Green, Department of Educational Leadership and Counseling Psychology, Doctoral Candidate

Researchers' Statement

We are asking you to be in a research study. The purpose of this consent form is to give you the information you will need to help you decide whether to be in the study or not. Please read the form carefully. You may ask questions about the purpose of the research, what we would ask you to do, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When we have answered all your questions, you can decide if you want to be in the study or not. This process is called 'informed consent.' We will give you a copy of this form for your records.

PURPOSE AND BENEFITS

Clinical research in hypnosis has demonstrated its utility for both acute and chronic pain, however a significant gap exists in the experimental research. Modern electrically induced pain such as transcutaneous electrical nerve stimulation (TENS) has not been tested against ischemic pain, nor been assessed using the same pain submaximal rating measure developed for ischemic pain. TENS is felt as a pulsing mild electrical shock. Ischemic pain is discomfort produced by having a blood pressure cuff inflated on your arm. Experimentally induced pain in hypnosis needs to take this significant stride forward. I therefore decided to make this my dissertation goal. Thus, the purpose of my dissertation is to compare experimentally induced ischemic pain and pain induced by TENS stimulation employing current instrumentation and methodology. My investigation may allow for a valid and reliable rationale in the use of TENS induced pain in experimental settings, a significant boon to future experimental research. Participants will benefit from experiencing hypnosis and attempting to alter their perception of painful stimuli.

PROCEDURES

Procedure

The experiment will take part in two phases.
Phase 1 (pilot study)

University volunteers will be exposed to a telephone questionnaire to prescreen participants in order to eliminate volunteers not likely to be suitable for hypnosis or pain perception. Next, written informed consent will be obtained at the initial face to face session according to standard IRB guidelines; next participants will be introduced to hypnosis (debunk myths, lecture, and demonstrations) (Barabasz & Watkins, 2007) to help maximize hypnotic performance. Subsequently, participants will be alternately assigned to TENS or ischemic pain conditions. Next, participants will fill out a questionnaire about their experience of pain. Participants will report pain levels until participants report it to approximate levels of clinical pain for each type of experimentally induced pain. Reported levels will assist to derive the settings of the tendency towards the best clinical pain approximation.

Phase 2

University volunteers will be exposed to a telephone questionnaire to prescreen participants in order to eliminate volunteers not suitable to hypnosis or pain perception. Next, written informed consent will be obtained at the initial face to face session according to standard IRB guidelines; next participants were introduced to hypnosis (debunk myths, lecture, and demonstration) to help maximize hypnotic performance. Subsequently, participants will be alternately assigned to TENS or ischemic pain conditions. Next, participants will fill out a questionnaire about their experience of pain.

For each pain condition (ischemic and TENS) the participant will follow 1st order or 2nd order of pain condition and hypnosis to eliminate any potential confounds of order effects. In the 1st order participants undergo the pain condition (ischemic or TENS) in a waking state with no suggestion, subsequently being asked by the experimenter to rate the pain in approximation to its closeness to that of clinical pain. Next, hypnosis will be induced using the Stanford Hypnotic Clinical Scale with an added suggestion for hypnotic analgesia using the procedure by Barabasz, (1982). Subsequently, participants will undergo the pain condition again and rate how closely their pain approximates clinical pain.

In the 2nd order, hypnosis will be induced first, rather than second, using the SHCS with an added suggestion for hypnotic analgesia. Subsequently participants will undergo the pain condition (ischemic or TENS) using hypnosis to manage their pain experience and report a pain rating in comparison to its approximation of clinical pain. Next, after being brought out of hypnosis, participants will undergo the pain condition again this time being asked by the experimenter to rate the pain in approximation to its closeness to that of clinical pain. A post-experimental inquiry will be conducted to determine if participants used any pain management techniques (especially participants with chronic pain) including hypnosis to deal with the pain condition. Each participant will commit between 1 to 2 hours of participation in total. All participants will be informed that they may refuse to answer any question or item in any questionnaire, or interview.

RISKS, STRESS, OR DISCOMFORT

Risks and Benefits

Risk of hypnosis and /or hypnotizability testing is reviewed in a recent chapter on hypnosis research designs and considerations (Barabasz & Barabasz, 1992). There have been occasional reports of negative consequences of hypnotherapy (see E. R. Hilgard, 1965, p.52) in cases of severely ill patients with long histories of illness. In contrast to these early findings, data obtained from over 600 patients treated in hypnosis and psychosomatic medicine unit in a large metropolitan general hospital (A. Barabasz, & Sheehan, 1983) revealed negative sequelae of hypnosis in only a single case which was successfully ameliorated by brief counseling. Unfortunately, the rare problems occurring in clinical situations have been misgeneralized to normal subject populations. In contrast to the potential problems following hypnosis with psychiatric patients, the incidence of hypnotic sequelae with university student populations presents a much less worrisome picture. Despite the fact that the Department of Health, Education and Welfare listed hypnosis as an "at risk" procedure in the 1970s (Coe & Ryken, 1979), there are very few data to support the notion that the use of hypnosis with university student and other normal populations is any more problematic than many of the normal activities students are subjected to in their daily lives.

Volunteer subjects who respond to induction procedures in hypnosis testing experience a number of unique phenomena. Therefore, it is not surprising to find reports of some transient experiences after exposure to hypnosis testing sessions. J. R. Hilgard, Hilgard, and Newman (1961) interviewed 220 college student subjects after administration of the Stanford Hypnotic Susceptibility Scale (SHSS) (as used in the present research). Only 17 subjects reported sequelae, and only 5 of these (2.3%) reported effects that lasted as long as a few hours. Sequelae were "minor and fleeting," J.R. Hilgard et al. (1961) concluded that hypnosis is generally harmless in a non clinical population.

Faw, Sellers and Wilcox, (1968) compared the aftereffects of three group hypnosis sessions on 102 subjects with the aftereffects of discussion groups over the same period of time (but no actual hypnosis) on 105 subjects. Subjects in the hypnosis group were judged pre-psychotic on the Minnesota Multiphasic Personality Inventory improved more on neurotic and behavior problem scales than did the nonhypnotized controls. At posttest, the no-hypnosis control subject group produced one psychotic and a higher incidence of difficulties with insomnia or nervous tension than the hypnotized-subject group. Coe and Ryken (1979) employed 209 introductory psychology students as subjects. The aftereffects of the SHSS were compared with the aftereffect of participating in a verbal learning experiment, taking a college exam, attending a college class, and college life in general. Coe and Ryken's results indicated that hypnosis was no more bothersome than any of the comparison activities.

Crawford, Hilgard, and Macdonald (1982) explored possible differences in the occurrence and type of transient experiences following SHSS with 172 undergraduate student volunteers. The minor transient experiences found were not viewed as constituting a risk to subjects.

The most recent thorough examination of hypnotic sequelae (Strauss, 1990) also found little if any risk to subjects. One subject reported paranoid ideas about hypnosis prior to

the time that he would have been scheduled to experience hypnosis. The point was made that had only a posthypnotic interview been conducted, the paranoid ideation might have been attributed to the hypnotic experience.

OTHER INFORMATION

Data will be confidential (linked to identifiers). Experimenters alone will have will have access to identifiable data. The data will be collected to run statistical analyses. The data will be retained until the conclusion of the study.

Printed name of researcher Signature of researcher
Seth Green
Date

Subject's statement

This study has been explained to me. I volunteer to take part in this research. I have had a chance to ask questions. If I have general questions about the research, I can ask one of the researchers listed above. If I have questions regarding my rights as a participant, I can call the WSU Institutional Review Board at (509)335-3668. This project has been reviewed and approved for human participation by the WSU IRB. I will receive a copy of this consent form.

Printed name of subject Signature of subject
Date