PAIN AND HYPNOSIS.

Catarina de Oliveira Tomé Lopes Pires

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Pain and Hypnosis

DISSERTATION THESIS

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This is to certify that:

The Present Dissertation: Pain and Hypnosis, presented by Catarina de Oliveira Tomé Lopes Pires, has been supervised by Jordi Miró Martinez, Professor at the Departament of Psychology of the Universitat Rovira i Virgili, in Fulfilment of the Requirements for the degree of Doctor of Philosophy.

31st of March 2014, Tarragona

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Jordi Miró Martínez, PhD

Aos meus pais, Carlos e Ilda

À minha irmã, Ana

Ao meu companheiro “on the road”, Luís

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INDEX

I. INTRODUCTION

INTRODUCTION

1. *On the experience of pain*

1.1. Defining pain

Pain is a universal experience (Kleinman et al., 1992). Pain is phenomenological at its core, which means that it is fundamentally a subjective and private experience (Pincus & Sheikh, 2009). For at least 30 years, pain has been scientifically defined by the International Association for the Study of Pain (IASP) as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage''(Merskey et al., 1979). Additionally, in the last fourteen years, pain has been conceptualized as a fundamental component of the body`s defence system (World Health Organization, WHO, 2000) as pain impels the individual to search for relief from the unpleasant noxious stimulus. Pain is ubiquitous and essential for survival (Turk & Melzack, 2011), being the most common complaint and symptomatic reason to seek medical consultation. Pain is one of the largest moneymakers for the world`s health-care industry, and it is a prevalent and costly problem in children, adolescents, and adults (e.g., Huguet & Miró, 2008; Langley et al., 2011; Perquin et al., 2000). An estimated 6.10 million (17%) of the adult population of Spain reported experiencing pain in the last month with daily pain being experienced by 7% of the population (Langley et al., 2011), whereas in children (8-16 years old) 37% reported having chronic pain and 5% moderate to severe chronic disabling pain (Huguet & Miró, 2008).

The IASP definition emphasizes the role of affect as an intrinsic component of pain; i.e. pain is always subjective and always unpleasant. However, pain has been considered for the most part an inevitable sensory response to tissue damage with little room for the affective dimension, and none whatsoever for the effects of genetic differences, past experience, anxiety or expectations (Loeser & Melzack, 1999). Pain researchers recognize that pain has both sensory and emotional features as well as an ability to command attention and dominate other cognitive processes (Chapman & Nakamura, 1999). Accordingly, pain is multidimensional with growing evidence showing that pain is a complex perceptual experience influenced by a

wide range of psychosocial factors, including emotions, social and environmental context, sociocultural background, the meaning of pain to the person, beliefs, attitudes, and expectations, as well as biological factors (Turk & Okifuji, 2002). The experience of pain and its meaning appears to change across situations and cultures as well as over time; cross-cultural studies prove the existence of differences in pain perception thresholds (Curtis, 2000; Miró, 2003). In recent years, great advances have been made in our understanding on the mechanisms that underlie pain and in the treatment of people with pain. Pain is a great challenge in terms of its explanation, biological meaning, psychosocial impact and interference, and treatment.

A number of contributions from psychologists have helped to shape the modern definition and conceptualization of pain, as pointed by Miró (2003). Firstly, the contribution of the development of the gate control theory (Melzack & Wall, 1965), secondly, the research work claiming the influence of psychological factors in the physiological activity implicated on the genesis of the pain problem (e.g., Blanchard et al., 1980), and finally, research pointing to the role of operant conditioning processes in the experience of pain (e.g., Fordyce et al. 1968).

1.2. Acute pain versus chronic pain

There are different ways of classifying pain, for example, in terms of its location (e.g. lower back pain, dental pain, joint pain, pain in the neck, headache, etc), or its cause (e.g. inflammatory pains, neuropathic pain – related to nerve damage, central pain – related to information processing in the central nervous system). Another very important dimension that is used to classify pain is time (i.e. duration of pain), as in chronic pain, which lasts a long time, versus acute pain, which is shorter in duration. Examples of acute pain is procedural pain, which arises from some medical treatment, for example, following knee surgery (e.g. Cupal & Brewer, 2001), cancer treatments (e.g. Syrjala & Roth-Roemer, 1996) or childbirth (e.g. Achterberg et al., 1994). On the other side, chronic pain can be defined as pain that persists, at

least for 3 months, and that resists conventional pain treatments. Merskey and Bogduk (1994) define chronic pain as "pain which persists past the normal time of healing. (...). In practice this may be less than one month, or more often, more than six months". For chronic back pain the usual time is 6 months, whereas in post-herpetic neuralgia 3 months of persisting pain is the more common time point at which the condition is dubbed chronic. Apart of this temporal distinction, there a number of features that allows us to distinguish acute from chronic pain. In terms of prevalence, acute pain seems to be more prevalent than chronic; which in fact has a biological meaning (i.e., it is useful as a warning signal) while chronic pain has no function, it is useless. Furthermore, in acute pain the cause is typically known whereas in chronic pain most of the time the cause is unknown, the beginning of acute pain seems to be more defined than in chronic pain, and in terms of treatment, in acute pain the cause (i.e. aetiology) is in focus, while in chronic pain a multidisciplinary intervention is in request. Therefore, with different biological meanings or functions, acute and chronic pain lead to different therapeutic approaches as they have a distinct psychological, biological, social, emotional, and cognitive impact. A key distinction between chronic and acute pain is the relationship the person creates with the pain. Pain is a familiar, emotionally-charged, meaning-laden, unwelcome, yet inevitable visitor for all individuals. As illustrated by Pincus and Sheikh (2009), the meaning of such a visit (i.e. pain) is completely different, if it is for an afternoon versus a weekend, if pain is going to stay only for tea, or if it is going to tag along with everything we do. Therefore, the distinction between acute and chronic pain is far deeper than an issue of duration. Psychological factors play an important role in the experience of pain, being argued that chronic pain interferes at a great extent on those variables and vice-versa, which requires demanding therapeutic strategies not only for pain control, but also for the impact that chronic pain has on the individual (in a number of different levels).

1.3. Chronic pain

Chronic pain is a major health problem, and hence, it might be expected that chronic pain would be well treated and under control; however most forms of chronic pain are poorly understood, and even when they are understood, the severity may not be adequately managed (Turk & Melzack, 2011). A large European survey revealed that chronic pain of moderate to severe intensity occurs in 19% of adults, seriously affecting the quality of their social and working lives. Results of the survey also showed that very few were managed by pain specialists and nearly half received inadequate pain management (Breivik et al., 2006). Thus, the impact of chronic pain proved to be high as revealed by the statistics: 66% had moderate pain (numerical rating scale - NRS = 5–7), 34% had severe pain (NRS = 8–10), 46% had constant pain, 54% had intermittent pain. Fifty-nine percent had pain for two to 15 years, 21% had been diagnosed with depression because of their pain, 61% were less able or unable to work outside the home due to pain problems, 19% had lost their job, and 13% had changed jobs because of their pain. Sixty percent visited their doctor about their pain 2–9 times in the last six months. One-third of the chronic pain patients were currently not being treated. Two-thirds used no medication treatments, e.g. massage (30%), physical therapy (21%), acupuncture (13%). Therefore, pain that persists for months and years, i.e. chronic pain, will influence all aspects of a person's functioning: emotional, interpersonal, vocational, and physical. Consequently, successfully treating chronic pain patients requires attention not only to the physical basis of the problem but also to the range of factors that modulate nociception and moderate the pain experience and related disability (Turk & Okifuji, 2002). In this process, integrating the care and interventions within a biopsychosocial framework is fundamental. The biopsychosocial model explains pain as a complex experience resulting from the interaction and influence of a number of factors, such as biological-physical (physiological, genetic), psychological (cognitive, emotional) and social (behavioural, professional and cultural) (Miró, 2003, 2008).

1.4. Chronic pain and psychophysiological variables: electrodermal activity and cognitive biases

Psychophysiological measures are primarily used as a tool to determine the influence of psychological factors in body functioning, and specially, to measure their contribution to the initiation and maintenance of symptoms. In many chronic pain syndromes, psychophysiological factors play a major role in the development and or maintenance of the problem (Flor & Turk, 2006). Overall, available studies suggest that responses to painful stimuli seem to be associated with characteristic peripheral physiological responses in the muscular, vascular and eccrine system (Flor & Meyer, 2011). Chronic pain patients have an extended history of frequent and strong connections between physiological response elements and meaning elements of pain (Bonnet & Naveteur, 2006). Hence, psychophysiological measures are of primary importance in the assessment of chronic pain syndromes, and are increasingly gaining importance in clinical pain research (Flor & Meyer, 2011). Initial attempts to measure psychophysiological concomitants of pain were undertaken in the 1950`s (e.g., Malmo et al.,, 1950), but only became accepted in the following decade when biofeedback methods came into broad use. Over the past 60 years, much evidence for the interaction of psychological and physiological variables in pain has accumulated (McMahon & Koltzenburg, 2005). However, much of the research related to the psychophysiology of pain still lacks adequate theoretical foundation and methodological rigor (cf. Apkarian et al., 2005; Flor & Turk, 1989), which represents a challenge for future research.

Psychophysiological data is of great importance as it serves a number of useful functions in the evaluation of acute and chronic pain states (Flor & Meyer, 2011); that is, they provide evidence on the role of psychological factors in maladaptive physiological functioning in specific patients, and may serve as predictors of treatment outcome (Flor & Birbaumer, 1993; Harris et al., 2008; Walitt et al., 2007). In experimental pain research, psychophysiological data have been used to examine concomitants of anxiety and general arousal associated with pain (Flor & Meyer, 2011). They have also served as measures of central processes related to pain

experience. It has been demonstrated that electrodermal activity (EDA) may be a useful autonomic indicator of sensitivity to pain (Dowling, 1982), reflecting the reactive component of the pain experience (Fowles, 1980). Skin conductance may be viewed as a measure of general arousal as it changes with the activation of the sweat glands that are responsive to psychological stimuli (Fowles, 1986). Their activity is mediated by the sympathetic nervous system. Often-used parameters of the sympathetic activity of the skin are the tonic skin conductance level or the phasic skin conductance response. Interest in this measure for the pain field comes from evidences showing that: (1) EDA reacts to pain in healthy volunteers (Baltissen & Boucsein, 1986; Dowling, 1983; Waid, 1979; Reeves, 1982) and chronic pain individuals (Öhman, 1972; Passchier & Orlebeke, 1983; Peters et al., 1989; Peters & Schmidt, 1989); (2) modification of EDA through the application of classical conditioning procedures is a reliable phenomenon (Öhman, 1972).

Findings on the significance of skin conductance measures for chronic pain have been controversial. As pointed by Flor and Meyer (2011), further research is needed to determine the role of peripheral psychophysiological variables in chronic pain. For example, Peters and Schmidt (1991) found enhanced skin conductance levels in response to stress in patients with chronic low back pain, but these results were not confirmed by Flor and colleagues (Flor et al., 1985, 1992). A number of studies on clinical pain research revealed that chronic pain patients significantly report increased electrodermal activity upon the presentation of pain questions (Salamy et al., 1983), and pain descriptors relevant to the patients` pain problem (Flor et al., 1997; Jamner & Tursky, 1987; Chapman & Martin, 2011). Such a different psychophysiological responsivity might serve as a basis for the early recognition of chronic pain and the detection of malingering (Salamy et al., 1983). Specifically, migraine episodes have been suggested to be related and somewhat maintained by highly specific conditioning or sensitization to pain-related stimuli (Jamner & Tursky, 1987). However, highly and unique specific conditioning to pain-related stimuli is still a debatable question (Knost et al., 1997; Larbig et al., 1996; Bonnet

& Naveteur, 2006). Further on, we will describe in greater detail the relationship between electrodermal activity and migraine. Although the relationship between physiological responses and meaning elements of pain is defended by a number of authors, it has been scarcely studied. In migraine pain, for example, only one study covered this matter (Jamner & Tursky, 1987).

On a cognitive level, individuals with chronic pain have been found to exhibit specific memory and cognitive bias (i.e., interpretation biases or the tendency to interpret ambiguous stimuli and situations in a threatening fashion) for pain related material (Edwards & Pearce, 1994; Pearce et al., 1990; Pincus et al., 1993, 1995, 1996). Attentional bias (i.e., selective attention to threat-related stimuli presented at the same time as neutral stimuli) for pain-related stimuli has been observed in chronic pain patients (Beck et al., 2001; Dehghani et al.,, 2003, 2004; Pearce and Morley, 1989). Moreover, a series of recent studies (Liossi et al., 2009; Liossi, White & Schoth, 2011; Schoth & Liossi, 2010) confirmed an attentional bias for pain-related words in chronic headache patients, supporting the content-specificity hypothesis, i.e. attentional bias was only presented towards pain-related cues (not for social threat, anger-threat and neutral stimuli). However, this relationship is still on debate (Asmundson et al., 1997; Asmundson & Hadjistavropoulos, 2007; Dear et al, 2011; Roelofs et al., 2002).

2. Migraine

2.1. Defining migraine

In the last 50 years vascular changes were considered the primary cause of migraine giving a very important role to the Central Nervous System (CNS) (Blau, 1987). However, the aetiology of migraine has been under debate. Nowadays the vascular theory of migraine appears to be scarcely adopted as migraine is now considered primarily a neurological disorder that secondly affects the blood vessels. Prior to the 1980s, there was little consensus about headache classification and diagnosis (Andrasik et al., 2011). However, in 1988, a classification system was finally created by the International Headache Society; i.e. International Classification of Headache Disorders (ICHD). This classification system was revised and updated in 2004 (see Table 1). Migraine is a complex type of headache that accounts for a fair number of body changes and distinct phases. Five phases have been described as part of migraine episodes (Blau, 1987; MacGregor, 2006), such as: (1) premonitory symptoms, (2) aura, (3) headache, (4) recuperation, (5) postdromal symptoms. The premonitory symptoms, both excitatory or inhibitory, relate to subtle neurological, (e.g., sensibility to light or concentration problems), behavioural (e.g., hyperactivity or tiredness), physical (e.g., pale face or chills), gastrointestinal (appetite for certain food and constipation), psychological (e.g., irritability and sadness, depression) and cardiovascular changes (e.g., tachycardia and bradycardia) that occur some hours or even a day before the beginning of the migraine episode. In respect to the second phase of migraine, aura symptoms may include seeing flickering lights, spots or lines, loss of vision, feeling of “pins and needles” or numbness. This phase distinguishes two types of migraine; i.e. with and without aura. Migraine with aura is defined as a focal neurological disturbance manifest as visual, sensory or motor symptoms (IHS, 2004). Approximately 20% of migraineurs experience aura, characterized by focal neurological features that usually occur in the hour preceding the headache (Andrasik et al., 2011). Phase three relates to headache, which tend to be moderate

to severe pain that lasts at least 4 hours, and is often unilateral with a pulsing quality, and may be aggravated by movement and activity. Associated symptoms may occur such as nausea, vomiting, vertigo, phonophobia (sensibility to sound) and photophobia (sensibility to light). Finally, the last two phases emphasise how the migraineur overcomes the migraine episode (e.g. sleeping, taking pain killers, vomiting), and the "hangover symptoms", which commonly are: humour changes, tiredness, limited tolerance to food, itchy muscles, occasional diuresis (Sandler & Collins, 1990).

Table 1. International Headache Society Migraine Diagnostic Criteria (2004)

Diagnostic criteria for migraine without aura according to the International Headache Society (IHS, 2004)	**Diagnostic criteria for migraine with aura according to the International Headache Society (IHS, 2004)**
A . At least 5 attacks fulfilling criteria B-D B. Headache attacks lasting 4-72 hours (untreated or unsuccessfully treated) C. Headache has at least two of the following characteristics: 1. unilateral location 2. pulsating quality 3. moderate or severe pain intensity 4. aggravation by or causing avoidance of routine physical activity (e.g., walking or climbing stairs) D. During headache at least one of the following: 1. nausea and/or vomiting 2. photophobia and phonophobia E. Not attributed to another disorder	A. At least 2 attacks fulfilling criteria B B. Migraine aura fulfilling criteria B and C for one of the subforms 1.2.1 – 1.2.6[1] C. Not attributed to another disorder

2.2. Migraine in numbers and figures: extension and burden

Although most headaches are benign, they can have a significant negative impact on functioning, productivity and quality of work, imposing a substantial burden on individual headache sufferers, on their families and on society (Andrasik et al., 2011). Stovner et al.

[1] 1.2.1. Typical aura with migraine headache, 1.2.2. typical aura with non-migraine headache, 1.2.3. typical aura without headache, 1.2.4. familiar hemiplegic migraine (FHM), 1.2.5. sporadic hemiplegic migraine, 1.2.6.basilar-type migraine

(2007) reviewed population studies for migraine, tension-type headache and chronic daily headache and estimated that the worldwide prevalence was 47% for headache, 10% for migraine, 38% for tension-type headache, and 3% for chronic daily headache. Further, lifetime prevalences were somewhat higher for headache (66%), migraine (14%) and tension-type headache (46%). In migraine, most large studies generate estimates in the 15%-20% range for females and 4%-7% range for men (Lipton et al., 2008). Most studies of migraine report that prevalence is higher in females at all post-pubertal ages and that it also varies according to age (i.e. prior to puberty, the prevalence of migraine is slightly higher in boys than in girls); migraine prevalence is at its highest between 25 and 55 years of age, typically the peak productive years of life (Lipton, Diamond, et al., 2001; Lipton, Stewart et al., 2001; Lipton et al., 2002; 2007). As pointed by Lipton et al. (2008), in the adult population, in every region of the world, and in every racial and ethnic group studies, migraine is two to three time more common among females than males.

2.3. Migraine triggers

According to the International Headache Society (IHS, 2004), migraine triggers increase the probability of having a migraine attack in the short term (usually <48 hours) being well documented (e.g. menstruation, chocolate, aspartame). Migraine triggers are related to the factors or circumstances that contribute to the onset of migraine. Accordingly, migraineurs are physiologically and perhaps psychologically hyperresponsive to a variety of internal and external stimuli, including hormonal changes, dietary factors, environmental changes, sensory stimuli, and stress (Silberstein et al., 2008) (see Table 2). Triggers differ in their quality and variety; although they may be common to a number of migraineurs they are not necessary the same in all migraineurs and are not the same, in different migraine episodes, for the same person (MacGregor, 2006; Pires, 2002). The identification of migraine triggers is not always easy as some migraineurs have difficulty in recognizing them. In a study conducted by

McGregor (2006), 79% of the migraineurs were able to identify their pain triggers, and the most common ones were stress, hormones, tiredness and hunger. Similar results were observed by Kelman (2007) reporting that 75% of the migraineurs were able to identify their migraine triggers, with the most common ones being stress, hormones, hunger, weather changes, sleep problems, strong smells, neck pain, lights sensibility, alcohol, smoke of cigarettes, heat/hot temperatures, food, exercise, and sexual activity. The majority of migraineurs, in Macgregor's study (2006) mentioned that a number of triggers were necessary to together induce a migraine episode. Accordingly, a "migraine threshold" determined by the genetic constitution of people has been proposed (see Figure 1). Pearce (1987 in Blau, 1987) and Welch (1990) had also suggested the existence of a threshold in the Central Nervous System (CNS). The "migraine threshold" appears to be enhanced or diminished due to external factors (e.g., stress), but also by brain internal changes. Granted that a certain number of triggers are needed to reach such a threshold, this would explain why a similar situation not always leads to a migraine episode (MacGregor, 2006).

For example, stress is a commonly referred migraine trigger. However, according to Barber (1996), there is no scientific support to that migraine is a result primarily of psychological factors, even though he recognizes the role of stress in the aggravation of the problem. The IHS refers to psychological stress as an aggravating factor rather than a trigger or precipitant of migraine. Examples of commonly-reported aggravating factors include: psychosocial stress, frequent intake of alcoholic beverages, other environmental factors. The relationship between stress and headache has long been reported in the literature (Henryk-Gutt & Rees, 1973; Howarth, 1965). Stress can change the interactions between the neuromatrix and peripheral stimuli, as can learned experiences and expectations (Loeser & Melzack, 1999). For any given person with headache, stress most probably operates in multiple ways and in concert with other, various biological influences. Negative thoughts and emotions emerging from the repeated experience of headache can become further stressors or trigger

factors in and of themselves (referred to as headache-related distress), serving at that point both to help maintain the disorder and to increase the severity and likelihood of future attacks. The biopsychosocial model of headache suggests that biological, psychological and social factors and their interaction all play significant roles in the experience and outcomes of headache disorders (Andrasik et al., 2005). Specifically in the case of headache, biological and pathophysiological predispositions and mechanisms may be "triggered" by the interplay of the individual`s physiological status (e.g., level of autonomic arousal) with environmental factors (e.g., stressful events, certain food, alcohol, toxins, hormonal fluctuations), and sequential factors that may serve to reinforce, and thus increase, the person`s probability of reporting head pain (Wagoner & Andrasik, 1990). Psychological factors do not play a causal role per se; rather they contribute to headache in various ways, such as: (1) triggering factors, (2) maintaining factors, (3) exacerbating factors, and (4) sequelae to continued head pain and subsequent life disruption (Andrasik et al., 2011).

Table 2. Migraine triggers (Silberstein et al., 2008)

MIGRAINE TRIGGERS	
Diet	Hunger, alcohol, additives, certain foods
Hormonal changes	Menstruation
Chronobiologic changes	Sleep (too much or to little), schedule change
Environmental factors	Light glare, odours, altitude, weather change
Head or neck pain	Or another cause
Physical exertion	Exercise, sex
Stress and anxiety	Letdown
Head trauma	-

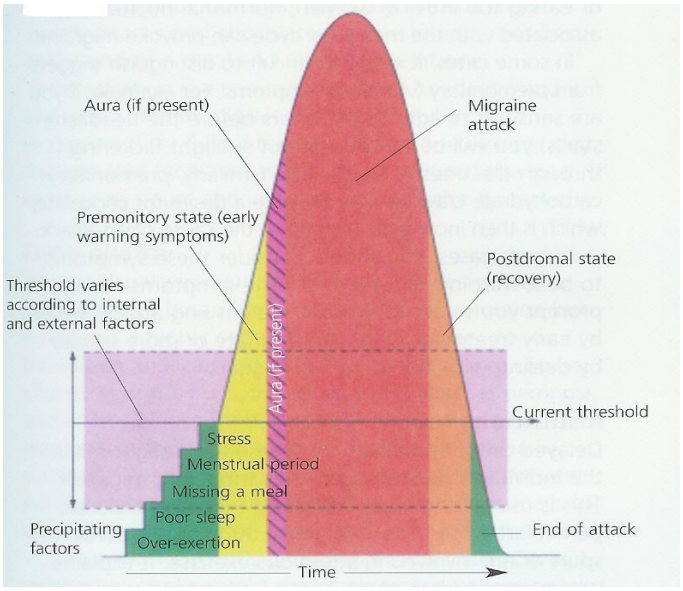

Figure 1. "Migraine Threshold" (taken from MacGregor, 2006)

2.4. Migraine and psychophysiological variables: electrodermal activity and the role of memory

In the early 90s, a number of theoretical explanations from the Psychology field had emerged which intended to give a better understanding of migraine (e.g. bio-behavioural theory by Joseph and Welch, 1987, 1990; imagetic bio-absorption theory – IBT - by Pires, 1990). The IBT explains migraine as both a memory and a psychophysiological deregulation problem (Pires, 1990; 2002). The main IBT basic assumptions are that: (1) migraine`s psychological activity is organized in schemes or patterns cerebrally controlled; (2) such patterns are "kept" in memory like prepositions; and (3) in proper conditions, such patterns or programs can be unchained, leading to a migraine episode. Then, the proper conditions act like mnemonic stimuli and such patterns and program may be triggered leading to a migraine episode. A possible memory for migraine pain is on the centre of the debate. According to Lang (1979), the bio-memories are related to a propositional pattern that includes information in respect to environmental, psychological, and biological oscillations. The IBT bases its theoretical framework on previous research work, such as the mentioned Bio-informational theory of emotional imagery (Lang, 1979), and research work on psychophysiological variables

related to migraine (Jamner & Tursky, 1987). The Bio-informational theory of emotional imagery Lang (1979) conceives the image or propositional structures in the brain to be a conceptual network, controlling specific somatovisceral patterns, and constituting a prototype for overt behavioural expression. The imagetic activities are associated with alterations in the autonomous nervous system (ANS). Accordingly, emotional response can be measured in at least three different systems - affective reports, physiological reactivity, and overt behavioral acts. As formerly mentioned, an altered cognitive processing of pain-related information and heightened reactivity to pain may contribute to the maintenance and exacerbation of chronic pain (e.g., Flor et al., 1990; Flor & Birbaumer, 1994; Turk and Flor, 1999). In fact, attentional bias for pain-related stimuli (Liossi et al., 2011; Liossi et al., 2009; Schoth & Liossi, 2010) was found in chronic headache patients revealing that both hypervigilance and sustained processing are critical factors for the maintenance of chronic pain. Specifically, research on psychophysiological variables shows that migraineurs may be highly conditioned or sensitised to migraine pain-related stimuli, which imply an emotional processing (Jamner &Tursky, 1987). This could be the result of the additional significance that pain descriptors have acquired from their repeated associations with the migraineurs' internal pain experience (Jamner & Tursky, 1987). In sum, stimuli that may trigger a migraine can be related to a specific migraine network or pattern that in turn is activated when considered the three types of information (i.e. stimuli, meaning and response) in the understanding of the body experience. Furthermore, it is important to remark that not only pain-related words, but also emotional stimuli might have an important role in migraine maintenance. Emotional stimuli and emotional states, such as negative affect, have been suggested as major migraine triggers (Puschmann & Sommer, 2011), and play an important role on the maintenance of migraine. Negative thoughts and emotions emerging from the repeated experience of headache can become further stressors or trigger factors in and of themselves (Andrasik et al., 2011). Hence, headaches can be

maintained or increased through a process of sensitization, failed habituation or lack of opportunities for learning to cope with the trigger (Martin & MacLeod, 2009).

Conclusively, it is proposed that the brain memorizes migraine-related emotions and bio-images, which can be modified by the individual through a learning process intending to change the psychophysiological patterns (Lang, 1987). Therapeutically, the IBT proposes the modification of the content and structure of an image; i.e. specific problematic migraine-related bio-images. IBT permits a systematic and deliberated manipulation, through verbal instructions, of the bio-images of the migraineur. Moreover, it relies not only on the use of imagination and relevant personal migraine-related images, but also hypnotic-type suggestions. Edmonston (1981) pointed that specific suggestions can be the active component of the treatment of migraine. The inclusion of hypnotic-type suggestions in the management of migraine aims to the modification of pain perception and control of a number of migraine-related physiological functions (Tomé-Pires & Pires, 2009). Hypnosis, which will be the next topic under discussion, is characterized by a state of high receptivity to suggestions intending to modify the subjective experience and, for example, teach to control physiological functions such as the vascular system (Barber, 1996).

3. Hypnosis

Granted its relevance, in this section we will emphasise the use of hypnosis as a therapeutic tool for pain management, especially in chronic pain by reviewing and examining its clinical use. Furthermore, granted that available studies have suggested a number of factors that should be considered in the explanation of hypnotic response to suggestions, we will specially address the role of psychological factors, such as hypnotizability, and expectancies, in hypnosis and hypnotic responding.

3.1. Defining hypnosis

Hypnosis has been conceptualized as a technique that usually contains an induction or introduction procedure "during which the subject is told that suggestions for imaginative experiences will be presented" (Green et al., 2005, p. 262). This inductive procedure is followed by suggestions "for changes in subjective experience, alterations in perception, sensation, emotion, thought, or behavior" (Green et al., 2005, p. 262). In hypnosis, changes in the subjective experience induced by suggestions occur, and are characterized by mental facility (relaxation), absorption (attention focus), reduction in the temporal-spacial orientation and automaticity (Rainville & Price, 2004). Moreover, hypnotic techniques being able to alter sensory awareness, perception, memory and behavior have the potential to influence physiological functioning and the course of medical conditions (Pinnell & Covino, 2000).

3.2. Hypnosis as a pain control technique

Hypnosis has had a cyclical history of acceptance and rejection since the time of Mesmer, two hundred years ago (Hilgard & Hilgard, 1994); frequently misunderstood, poorly accepted and greatly underutilized. Most health care professionals have little accurate information about hypnosis, and their attitudes and beliefs are often based on misinformation (Thomson, 2003). Nevertheless, hypnosis has now attained a significant place in medical and

psychological science. Accordingly, the scientific foundations upon which the understanding of hypnosis is based have become much firmer in the last decades (Hilgard & Hilgard, 1994).

In the course of research, much has been learned about the effectiveness of hypnotic procedures in the relief of pain. Over the past 20 years, a significant body of research has grown to support hypnosis for the treatment of pain, and in general, scepticism from a scientific standpoint is no longer warranted (Patterson, 2010). As described by Hammond (2007), hypnosis meets the criteria for an empirically well established and supported treatment. Published reports, systematic reviews, and meta-analyses have demonstrated that hypnosis is effective in the management of pain in adults for acute, chronic, or cancer procedure-related pain experiences (Castel et al., 2007; Hammond, 2007; Hawkins, 2001; Lynn et al., ,2000; Jensen et al., 2011; Jensen & Patterson, 2006; Montgomery et al.,2000; Stoelb et al., 2009). Montgomery et al.`s review (2000) of randomized controlled studies found that hypnosis produced pain relief in 75% of the population. Findings revealed a moderate-large effect of hypnosis in both experimental and clinical pain. Furthermore, hypnotic procedures have been found to produce significantly greater pain reduction in a variety of chronic pain types comparing with no-treatment/standard care and some non-hypnotic interventions, such as education/advise, supportive therapy, medication management or physical therapy (Elkins et al.,2007; Jensen & Patterson, 2006; Stoelb et al., 2009). Besides, the effects of hypnosis as an adjunct treatment to other treatments for chronic pain, for example standard medical care, lead to greater pain reduction than those without (e.g., Liossi & Hatira, 2003; Liossi et al., 2006, 2009). Additionally, research has suggested that hypnosis performs similarly to treatments that contain hypnotic elements (such as progressive muscle relaxation), but is not surpassed in efficacy by these alternative treatments (Jensen & Patterson, 2006; Stoelb et al., 2009).

The effects of hypnosis are gradual and different among individuals; i.e. some patients are primarily able to reduce their psychological distress associated to pain, while other

patients can reduce either intensity of pain and pain-related psychological distress (Barber, 1996). The main objective of a hypnotic treatment is not to change pain during hypnosis, but to give suggestions and teach skills and strategies that will alter pain intensity and its daily impact effects (Jensen & Patterson, 2006). Hypnosis has beneficial effects both on pain-related outcomes (e.g. pain intensity, duration, frequency, analgesic medication use), and non-pain related (e.g. anxiety, sleep, quality of life). As referred by Ordi (2005), the benefits of hypnosis could be briefly summarized in the following ones: (1) it contributes to the reduction and relief of pain; (2) its use as an adjunctive tool to other medical and psychological techniques allows the achievement of successful therapeutic results with less time and effort from the patients; (3) hypnotic suggestions emphasise positive attitudes in respect to coping and problem solving, promote the active role of the patient in his/her therapeutic change, make use of imaginative abilities and rely on an emotional implication, favour the relaxation response, and finally, lead to quick changes in the patient`s behaviour which in turn enhance his/her motivation and adherence to treatment. Besides the positive effects that result from the use of a hypnotic intervention, it is important to note that hypnosis is a very economic pain control tool, easy to administrate, able to reduce the medication costs in respect to conventional medical treatments and with no adverse side effects (Hammond, 2007; Kohen & Zajac, 2007; Tsao & Zeltzer, 2005) or as pointed by Jensen (2013), hypnosis has many “side effects” that are overwhelmingly positive.

3.3. Hypnosis in the management of chronic pain in children and adolescents and its clinical use by health professionals

By the end of the 19th century, those who had studied the field of hypnosis already knew that children were suitable hypnotic subjects, that the peak of hypnotizability occurred in middle childhood, and that hypnotic techniques were applicable to a wide variety of childhood medical and psychological problems (Olness & Kohen, 1996). More modern interest in using

imaginative and hypnotic techniques with children developed in the 1960s and 1970s with the research and writings of icons in the field, including J. R. Hilgard (1970), Fromm (1972, 1979), Erickson (1958), Gardner (1974, 1977), Boswell (1962), and Singer (1973, 1974) (Lynn et al., 2010).

A few controlled studies (e.g. Kellerman et al.,1983; Olness et al.,1987; Vlieger et al., 2007), non controlled studies (e.g., Anbar, 2001a,b; Kohen & Zajac, 2007) and case studies (Olness & MacDonald, 1981) confirm the efficacy of hypnosis as a pain control tool in children and adolescents. Surprisingly, although children and adolescents are considered good hypnotic subjects (Ollness & Kohen, 1996; Wood & Bioy, 2008), there is very little systematic research on this matter.

Among the issues that still await clarification or additional studies are, as mentioned by Jensen and Patterson (2006), a common operational definition of hypnotic analgesia; the lack of standardization of hypnotic protocols, and the need to identify the components of a hypnotic intervention. Effects and mechanisms of hypnotic analgesia can be examined by conducting component and process analyses (Jensen & Patterson, 2006). Component analyses relate to how hypnotic treatments differ from each other in content (e.g. different induction or suggestions) or dose (number of treatment sessions). On the other side, process analyses are performed to identify predictors or covariates of treatment outcome (e.g. hypnotizability, motivation, relaxation, dissociation) (Jensen & Patterson, 2006). For example, hypnotizability, that is, a person's ability to experience and respond to hypnosis in general, has been suggested as a predictor of positive treatment outcomes (e.g., Jensen & Patterson, 2006; Hawkins et al., 1998) and of clinical relevance in diminishing patient`s response to pain (see Chaves, 1989).

Therefore, knowledge on the hypnotic effects requires the need to determine, for example, the extent to which there is a dose effect for hypnotic analgesia as well as a content effect (Patterson & Jensen, 2003), and test the nature of the hypnotic suggestions. Future studies could benefit from identifying when, for what, and for whom a hypnotic intervention is

appropriate and whether it should be administrated alone or in combination with other techniques.

Similarly, another area that deserves additional effort is that of how hypnosis is delivered. For example, what are the specific features of a hypnotic session that make them successful in the context of pediatric chronic pain? Although hypnosis has proven efficacy in the treatment of chronic pain in young patients, the treatment encompasses a large variety of techniques, some of which might be more effective than others. Knowledge of the specific strategies that are actually endorsed by health care professionals and the factors that influence their use could be useful. Moreover, a number of factors might influence a clinician`s decision regarding the use of hypnotic techniques (i.e. induction and suggestions), such as: (1) his/her clinical orientation (e.g. altered state of consciousness and socio-cognitive phenomenon), (2) years of practice with hypnosis, and (3) age of the patients. It can be the case that the way clinicians describe hypnosis might have an influence in the selection of hypnotic techniques. For example, a clinician endorsing an altered state orientation (e.g. Bowers, 1966; Orne, 1959) might be expected to use techniques aiming to deep such a state, whereas a clinician endorsing a social-cognitive orientation might not give such importance to induction techniques since hypnotic response is a product of social influence and personal abilities of the person hypnotized (i.e. alike other complex social behaviours: a product of ability, attitude, belief, expectancy, attribution, interpretation of the situation; e.g. Barber, 1969; Kirsch, 1991; Sarbin, 1950;). Additionally, another factor that might also influence the use and selection of hypnotic techniques is clinical experience with hypnosis. It might be expected that as clinicians become more and more experienced certain techniques are more endorsed than others; a number of strategies may be more often used has it might have a greater chance of being most effective. Finally, age of young patients could influence likewise the specific inductions and hypnotic suggestions selected. There is evidence supporting that hypnotherapeutic inductions and suggestions should fit children`s developmental stage as well

as social-emotional needs (Ollness & Kohen, 1996). Success work with children requires that the professional adapt induction procedures and suggestions to the age of the child (Kohen in Hammond, 1990; Olness & Gardner, 1988). Therefore, differences in the content of the hypnotic sessions (e.g. different induction or suggestions) can be in part due to age of participants, but also, due to clinicians` orientation and years of practice. It would be interesting to further analyse the contribution of such factors on the use of specific hypnotic techniques for the management of pain in youths.

3.4. Underlying mechanisms of hypnosis

Although 60 years of experimental research have clarified much of the nature of hypnosis and the limits of its effects, its underlying mechanism remain, for the most part, controversial (Barnier et al., 2008). On the one hand, hypnotic responses have been argued to reflect relatively mundane psychological processes, such as expectancy, and then require no special or additional explanation (e.g., Braffman & Kirsch, 2001; Sarbin, 1992, 1993; Spanos, 1986; Wagstaff, 1981, 1998), and on the other hand, it has been argued that hypnotic responses reflect a fundamental transformation in cognitive processing (e.g., Hilgard, 1974, 1992; Kihlstrom, 1997, 1998, 2003; Woody & Bowers, 1994), giving special attention to the exaggerated phenomenology considered the hallmark of hypnosis (Barnier et al., 2008). Examples of exaggerated phenomenology are related to straightforward verbal communications from the hypnotist, disruptions of personal agency and transient delusion about the source and reality of their experiences. These two qualities, which Kihlstrom calls “experienced involuntariness bordering on compulsion” and “conviction bordering on delusion”, have remained central to definitions of hypnosis (Barnier et al., 2008). A number of psychological factors (e.g., hypnotizability, response expectancies, imaginative involvement, absorption, attitudes) have been proposed as relevant to explain the occurrence of hypnotic behaviour (e.g., Barber, 1969; Braffman & Kirsch, 1999; Council et al., 1986; Henry, 1985;

Kirsch, 1985; Milling et al., 2006; Patterson et a., 1997; Spanos, 1986); however there is not a consensus on which of them is more important if any, or whether an interaction among several is central. The identification of the key factors, not just psychological, but also biological and social that can predict individual`s response to hypnosis would allow to have a better understanding of hypnosis processes and responses.

Socio-cognitive research proposes that hypnotic responding is a product of expectancies (Barber, 1969; for modern analyses, see Braffman & Kirsch, 2001; Kirsch, 1995, 1997, 2001), and that expectancies are the sole proximal determinant of hypnotizability (Braffman & Kirsch, 1999; Gandhi & Oakley, 2005; Kirsch, 1985; Lynn et al., 2008; Kirsch, 2001). Expectancies are defined as specific expectations for non-volitional outcomes (Kirsch, 1991, 1995), which reflect automatic processes that directly cause expected outcomes. Accordingly, a variety of hypnotic responses can be altered by manipulating people`s expectancies; i.e. typical hypnotic responses can easily be altered by providing subjects with expectancy-altering information (Kirsch, 1991). Consequently, expectancies about being hypnotized are important for its confirmation, contrarily to its violation as advocated by the Discrepancy-Attribution Theory (Barnier et al., 2008). However, the role of expectancy in hypnotic response is still in debate. For example, very recently, it has been suggested that there is a complex relationship between hypnosis and expectation, which is hardly reciprocal (Lifshitz et al., 2012). The former authors also claimed that response-expectancies are likely insufficient to improve responsiveness to a suggestion to override a deeply-ingrained automatic process. On addition, the empirical study of expectancies has been extensively using a type of methodology (i.e. assessment after the person is exposed to the hypnotic procedure) that may lead to overvalue the role of expectancies. According to Kirsch (1991), the measurement of expectations before induction fails to find strong relationships between expectations and responsiveness. Nevertheless, the assessment of expectancies after hypnosis can contribute to the fact that the person is fully aware of the benefits achieved via hypnosis, and positive results obtained thought hypnosis

may, thus, motivate and make the person more receptive for the assessment. Future research is warranted to investigate expectancies controlling for order (counterbalance assessment), and test its predictive value in explaining hypnotic response (since it has been argued to be a determinant of hypnotic response). Furthermore, the subjective experience related to hypnosis has received little attention (Barret, 2007; Pekala & Kumar, 2000) and perhaps not in the most appropriate manner (Barret, 2007; Woodard, 2003). Accordingly, a comprehensive hypnotic responsivity assessment methodology should be able to assess hypnotism (according to Pekala, the term hypnosis is reserved for the state, while hypnotism is reserved for the production, for the study and use of suggestions with the state of hypnosis presumably being present).

II. OBJECTIVES

OBJECTIVES

In this work we focused on migraine pain at a cognitive and psychophysiological level, as well as on the use of hypnosis for the management of pain. As evidenced by the literature, chronic pain has been associated with cognitive biases and enhanced electrodermal activity to pain material. Although, little is known about a potential conditioning or sensitization to emotional material in migraineurs, as in chronic pain in general, it could be the case that emotional stimuli also produces similar psychophysiological effects as to pain-related stimuli. Additionally, on a cognitive level, pain-related and emotional stimuli may lead to a memory bias. Hence, these factors could contribute to the maintenance and exacerbation of migraine. Additionally, hypnosis seems to be a good therapeutic tool to intervene in pain memories aiming to change not only the sensorial qualities of pain, but also the perception of such an experience (affective and cognitive qualities). Hypnosis has been used as a pain control technique worldwide by health professionals both with adults, children and adolescents, proving positive results. Hypnotic responsiveness (i.e., response to hypnotic suggestions), appears to depend on a number of factors; clarification of potential contributors is of central interest to those involved in the management of chronic pain.

The main objectives of this doctoral dissertation were to:

1. Analyse the relationship between migraine and electrodermal activity, testing the evidence of a highly specific conditioning to pain-related and negative emotional material in migraineurs, and study whether there is a cognitive biases (i.e. memory recall) in migraineurs
2. Study hypnosis in the management of chronic pain. Specifically the objectives were to:

   2.1. Evaluate the use and effects of hypnosis in the management of pediatric chronic pain. That is: a) systematically review the use of hypnosis in children with pain problems and the importance of one of the most widely studied predictors of hypnotic response in child hypnosis; i.e. hypnotizability, and b) examine the

frequency of use of specific hypnotic techniques (i.e. inductions and suggestions), and whether they vary as a function of age of patients, and theoretical orientation and years of experience with hypnosis of health care professionals.

2.2. Examine the use of hypnosis in adults. That is: a) test the value of expectancies in hypnotic responsiveness (following a phenomenological perspective)

III. METHOD

In this section, we will briefly describe the methods used within each study, a full description can be found in each article included in this dissertation.

In study I, we conducted an experiment comparing electrodermal activity and memory recall to different words (i.e. pain-related, emotional and neutral) between migraineurs and headache-free controls. In study II, we conducted a review on randomized control trials (RCTs) on the use of clinical hypnosis in the management of chronic pain in children and adolescents looking for evidence of its effectiveness as a pain control technique. In study III, we conducted an online survey in order to gather information on the use of hypnotic inductions and suggestions in the management of pediatric chronic pain. In study IV, we conducted an experiment assessing the role of expectancies on phenomenological experience of hypnosis (i.e. altered state of consciousness and hypnoidal state).

We have used a wide array of questionnaires to assess the variables of interest in each of our studies. A complete description of each one of them is beyond the objectives of this work, and so we decided to just list them in a table along with their references, addressing the interested reader to look for specific descriptions in each one of the papers included in this dissertation. Since study II and III were a review and an online survey, respectively, and were not included in Table 3.

1. Participants

Three samples participated in our studies. First, a convenience sample of adults (N=66; 35 migraineurs and 31 headache-free controls; study I) who voluntarily agreed to participate in an experiment on migraine. Those in the migraine group complied with the criteria of the International Headache Society for the diagnosis of migraine with or without aura (International Headache Society, IHS, 2004). The second sample consisted in 35 health professionals who voluntarily agreed to participate in a study about the use of clinical hypnosis in the management of pediatric chronic pain (study III). Inclusion criteria for this study were to

have experience: (1) in clinical research on this topic (at least, being the first author of 1 paper or the co-author of 2 papers on the use of hypnosis in pediatric chronic pain) or (2) in clinical work (at least, 2 years of experience working in the context of pediatric chronic pain). The third sample was composed by 152 students of Psychology (study IV). Finally, the other paper included in this dissertation were based on a specific review technique; i.e. a systematic review (study II).

2. Procedures

Specific procedures for the experiments conducted are described within the papers included in this dissertation, and will be not specifically presented here due to their diversity and for a matter of brevity and limitation and economics of space. We do describe the review procedures in order to clearly differentiate those that were used, granted that they do follow different objectives. Finally, we also summarize the procedure used to collect information from healthcare professionals in relation to the use of hypnosis in pediatric chronic pain management.

In study II, we conducted a ***systematic review***, which has been defined as a critical assessment and evaluation of all research studies that address a particular clinical issue. As such, we used an organized method of locating, assembling, and evaluating the literature on the use of hypnosis in the management of chronic and procedure-related pain in children (a complete description and key words used are reported in our article included in this dissertation).

In study III, in order to gather information on the use of clinical hypnosis with young chronic pain patients, we developed a survey (in English) in collaboration with clinicians and researchers from The Milton H. Erickson Institute of Rottweil (Germany), and also experts using hypnosis. The final version of the survey included 89 questions and was divided in three sections: (1) demographic and descriptive information about the clinician; (2) clinical and

research experience information about the respondent; and (3) information about the use of hypnosis with children and adolescents with chronic pain. The survey had to be answered on-line (a complete description of how this was conducted is reported in our article included in this dissertation).

3. Measures

For sake of brevity, we summarize the measures in the following Table 3.

Table 3. Variables and measures of studies I and IV

Studies	**Variables**	**Measures**
Study I	Electrodermal activity	Amplitude of skin conductance response (microSiemens, µS)
	Pain descriptors	McGill Pain Questionnaire (MPQ)
	Pain intensity	Numerical Rating Scale (0-10)
	Headache impact	Headache Impact Test (HIT-6)
	Psychological distress (anxiety, depression)	Hospital Anxiety and Depression Scale (HADS)
	Pain fear cognition (catastrophizing)	Pain Catastrophizing Scale (PCS)
	Personality dimensions	Zuckerman-Kuhlman Personality Questionnaire
	Memory recall	Recall of words after the experiment (immediately or delay)
Study IV	Expectancies	Pre-assessment form of PCI-HAP[1]
	Hypnotic phenomenology	Phenomenology of PCI-HAP
	Beliefs and attitudes about hypnosis	VBAHS-C[2]
	Anxiety	Zung Self-Rating Anxiety Scale (Zung)
	Depression	Centre for the Epidemiological studies-Depression (CES-D

[1]Phenomenology of Consciousness Inventory Hypnotic Assessment Procedure (PCI-HAP); [2]Valencia Scale of Beliefs and Attitudes about Hypnosis-client version (VBAHS-C)

IV. RESULTS

Study I

Tomé-Pires, C and Miró, J (*in press*). Electrodermal responses and memory recall in migraineurs and headache-free controls. *European Journal of Pain*

Study II

Tomé-Pires, C and Miró, J (2012). Hypnosis for the management of chronic and cancer procedure-related pain in children. *International Journal of Clinical and Experimental Hypnosis* 60: 4, 432-457

Study III

Tomé-Pires, C, Solé, E, Racine, M, de la Vega, R, Castarlenas, E, Jensen, MP, Miró (2014). Use of hypnotic techniques in children and adolescents with chronic pain: do age of patients, and years of practice and theoretical orientation of clinicians matter? Submitted to *International Journal of Clinical and Experimental Hypnosis*

Study IV

Tomé-Pires, C, Ludeña, MA and Pires, CL (*in press*). Expectancies and hypnotic responsiveness: an experimental design flaw revealed. *International Journal of Clinical and Experimental Hypnosis*

1. Study I: Electrodermal responses and memory recall in migraineurs and headache-free controls

Electrodermal responses and memory recall in migraineurs and headache-free controls

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Running head: Electrodermal responses and memory recall in migraineurs

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ABSTRACT

Background: Chronic pain patients show increased peripheral activity when exposed to stimuli relevant to their pain problem. It has been suggested that in migraine there is a highly specific conditioning or sensitization to pain stimuli. The aims of this study were to analyse whether migraineurs (1) are not only sensitive to pain-related stimuli but also to other negative emotional stimuli, and (2) show a memory bias for pain stimuli, when compared to headache-free controls. **Methods:** 66 adults participated in the study ($\bar{X}$= 27 years; SD= 7). They observed 30 words (pain or negative emotional or neutral) in a pseudo-randomized order. Subsequently, participants were asked to recall the words presented during the trial. Results: Skin conductance responses (SCRs) induced by pain descriptors and emotional words were very similar to each other and significantly larger than those induced by neutral words; however there were no differences between both groups in SCRs. Significant differences in immediate memory recall were found between the two groups: migraineurs recalled more emotional words than controls. **Conclusions:** The findings suggest that in migraine, not only pain-related but also negative emotional stimuli, may pose a threat. These outcomes may have therapeutic implications as interventions could target problematic pain-related memories that influence migraine pain perception and pain-related physiological responses.

Keywords: electrodermal activity, memory recall, migraine, pain descriptors, emotional migraine triggers

INTRODUCTION

Migraine episodes have been suggested to be related and somewhat maintained by highly specific conditioning or sensitization to pain-related stimuli. Sensitization to these stimuli would occur as a result of the additional significance that they acquire from repeated associations with the patient's internal pain experience (Jamner and Tursky, 1987). However, highly and unique specific conditioning to pain-related stimuli is still a debatable question (Knost et al., 1997; Larbig et al., 1996). For example, Bonnet and Naveteur (2006) found that larger skin conductance responses were also induced by negative emotional words unrelated to pain. In migraine, pain is a high involving experience, mainly processed in cortical zones devoted to the emotive and affective aspects of nociception (de Tommaso et al., 2005). Thus, it might be that not only pain-related stimuli enhance peripheral activity but also negative emotional words may exert such effect. Emotional stimuli and also emotional states, as negative affect, may act as migraine triggers (Janseen, 2002; Puschmann and Sommer, 2011). To this point, no study has analyzed whether negative emotional stimuli unrelated to pain may, in fact, induce similar reactions as pain-related stimuli would do in migraineurs. Learning about if and how stimuli, other than pain-related ones, result in migraine episodes would help to understand better migraine pathophysiology and improve preventive and palliative interventions for migraine-related pain.

It has been demonstrated that chronic pain patients selectively recall pain-related words (Pearce et al., 1990) and display selective attention towards pain-related material (Liossi et al., 2011). Information processing in both attention and memory for pain-related stimuli is not only associated with pain but also seems to be dependent on the emotional state of patients and on trait predisposition to fear of pain (Asmundson et al., 1997; Keogh et al., 2001). Thus, certain emotional states and internal personal characteristics of patients, like anxiety and pain catastrophizing, may be associated with memory biases for pain and

sustained migraine episodes. Although of therapeutic interest, there is not any study looking into these issues in migraineurs.

Electrodermal activity (EDA) has been suggested as a useful predictor of sensitivity to pain (Dowling, 1982), reflecting the reactive component of the pain experience (Fowles, 1980). EDA reacts to pain both in healthy volunteers (Baltissen and Boucsein, 1986) and chronic pain patients (Peters and Schmidt, 1989). In their seminal work, Jamner and Tursky (1987) reported that skin conductance responses to pain words were significantly larger in migraineurs than in headache-free controls; neutral, emotional pain-unrelated or body-related stimuli have failed to produce the same psychophysiological effects in chronic pain patients (Flor et al., 1997). In this work, we studied EDA to test the following hypotheses: (1) migraineurs will be more sensitive than headache-free controls not only to pain-related stimuli, but also to negative emotional stimuli; (2) migraineurs will show a memory bias for pain stimuli by recalling more pain-related words than other types of words; and (3) memory biases to pain stimuli will be related to emotion, and cognitive-related variables as anxiety, depression, and pain catastrophizing in migraineurs.

METHOD

Participants

Participants (N=66) were a convenience sample of adults who voluntarily agreed to participate in the study; 35 migraineurs and 31 headache-free controls participated. Those in the migraine group complied with the criteria of the International Headache Society for the diagnosis of migraine with or without aura (International Headache Society, 2004). Those in the headache-free control group were to (a) be headache free (1 episode in 6 months), and (b) not experience any chronic pain problem. All participants signed a consent form. After the experiment, participants were debriefed.

Stimuli

First of all, a set of tasks had to be conducted to identify the stimuli (i.e., the words) that would be used in this study. Subsequently, the study per se was implemented. Therefore, the initial and preparatory activities will be described first.

Word selection

Sensory pain-related words were selected from the seminal work by Jamner and Tursky (1987), who had selected pain words from the McGill Pain Questionnaire (sensation scale of the PPP; Melzack, 1975), and the Headache Scale (Hunter, 1983). Spanish word equivalents were taken from the Spanish version of the McGill Pain Questionnaire (Lázaro et al., 1994).

Neutral words were taken from the study by Liossi and colleagues. Liossi et al (2009) selected neutral words using the Self-Assessment Manikin method (Bradley and Lang, 1999). 10 neutral words were rated on a 9-point scale on the emotional valence (1= unpleasant, 5= neutral, and 9= pleasant) and arousal (1= calm, 9= excited), which allowed to gather data about the level of pleasantness and arousal of the words. The neutral words were chosen to be in the middle range on pleasantness and low on arousal.

Our list of negative emotional words was somewhat based on Bonnet and Naveteur's (2006) work. They used the words cadaver, war and murder. We asked a group of twenty-nine healthy volunteers between 20 and 55 years old (mean age= 31; 9 males; 20 females) to give us a list of 5 words equivalent to the ones used by Bonnet and Naveteur (2006). The specific instructions were: "*Based on these three negative words, please name five other words of the same negative emotional nature*". We used the most commonly suggested words to form a list of negative emotional words, which included those used by Bonnet and Naveteur (2006).Then we asked another group of individuals to evaluate all the words selected and rate them on a scale from 0 to 10 just as Bonnet and Naveteur (2006) did, for their: (a) physical content, (b)

emotional content, and (c) frequency of use. A total of 18 volunteers aged between 20 and 44 years old ($\bar{X}$= 30 years; SD= 5.59; 61% women; 39% suffering from migraine) participated in this task. Subsequently, the three word lists were carefully matched for number of letters. The words were presented in a randomized order and the participants were asked to rate each of them between 0 and 10 on the three mentioned scales.

Scores on the three scales were compared between migraineurs and controls. Pain descriptors from all scales (physical, emotional and frequency) scored higher on the pain scale, whereas the negative emotional words scored higher on the emotional scale (see Supplementary Material). Therefore, our pilot study enabled us to collect and select not only pain descriptors but also emotional words and neutral words. Finally, we ended up with a list of 10 words in each category.

Procedure

Participants were shown 30 words for 12 seconds (10 sensory pain-related, 10 neutral and 10 negative emotional words; see Supplementary material – Table 2). In order to counterbalance for possible order effects, the presentation of the stimuli was pseudorandomized with uniform random numbers (i.e. random number generation - EasyFitXL; D. uniform distribution; this function is based on the Mersenne Twister random number generation algorithm - Pseudorandom number generators, PRNGs). The inter-trial interval was also pseudorandomized in the same manner in the range from 6 to 18 seconds so that the effects of anticipatory responding associated with fixed-interval stimulus presentation was reduced. Word categories were matched for word length (4-13 letters). The experiment was performed in a room in which temperature ranged between 20 and 24ºC and was dimly illuminated and sound attenuated. Participants were seated on a comfortable chair facing a video monitor (1 meter from the participants) and words appeared on a white screen.

Participants were instructed to observe and think about the meaning of each word when displayed on the computer screen. They were also asked to avoid unnecessary movements. Participants were put through three phases: (1) an adaptation period (tonic conductance level for 8 minutes), in which the participant was instructed to relax, and the baseline period; (2) a practice trial which included an example of the word presentation task (duration: 3 minutes) and the word presentation task (duration: 12 minutes); and (3) final post baseline period (2 minutes). At the end of the experiment, participants were asked to recall the words presented during the trial (task duration: 3 minutes). Then, they were given a distraction or interference task (i.e., writing the alphabet from Z to A and the numbers from 100 to 0 for 5 minutes) followed by another memory task to test the delayed recall of the words in the study (duration: 3 minutes). The experiment lasted 40 minutes. After the experiment, participants completed a number of questionnaires (see specific information below). Finally, they were debriefed and thanked for their participation.

Pain

A Numerical Rating Scale was used to gather information on participant's present pain (i.e., pain at the time of the experiment) and usual pain intensity: a "0" indicated "no pain" and a "10" indicated "pain as bad as it could be. Numerical rating scales have shown their validity and reliability as measures of pain. We also asked about the duration and frequency of migraine episodes.

Pain descriptors

Using the McGill Pain Questionnaire (MPQ; Melzack, 1975; Lázaro et al., 1994), participants chose those words they considered best described the pain they experienced during their migraine episodes. The MPQ consists of three major classes of word descriptors distributed along three dimensions: sensory, affective and evaluative. During the clinical

interview we also asked migraineurs about the pain words most commonly used to describe their migraine.

Pain triggers

We also collected information about the pain triggers that participants identified as playing an important role in the onset of a migraine episode.

Headache impact

The Headache Impact Test (HIT-6; Bayliss and Batenhorst, 2002; Kosinski et al., 2003) was used to assess the impact that headaches had on the individual's ability to function at work, school, home and in other social situations. The HIT-6 consists of six items: pain, social functioning, role functioning, vitality, cognitive functioning and psychological distress. The patient answers each of the six related questions using one of the following five responses: "never", "rarely", "sometimes", "very often", or "always". The range of possible scores with HIT-6 is between 36 and 78. Higher scores indicate greater impact on the individual's life.

Anxiety and depression

The Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983; Herrero et al., 2003) was used in this study. Scores ranged from 0 to 21. A score of 0 to 7 for either subscale is regarded as normal, a score of 11 or higher indicates the probable presence of mood disorder, and a score between 8 and 10 suggests the presence of the respective state.

Pain catastrophizing

We used the Pain Catastrophizing Scale (PCS; Sullivan et al., 1995; Miró et al., 2008) to measure catastrophic thoughts. The PCS yields a total score and three subscale scores that assess rumination, magnification and helplessness. Participants were asked to indicate

whether they agreed with the statements by using a 5-point rating sale (0 = 'not at all') to 4 = 'very much'). Higher scores indicate higher levels of pain catastrophizing. The measure has demonstrated criterion-related, concurrent and discriminant validity in community samples.

Personality dimensions

The Zuckerman-Kuhlman Personality Questionnaire (ZKPQ-50-CC; Zuckerman et al., 1993; Aluja et al., 2006) is a shortened 50-item version of the ZKPQ consisting of five personality scales of 10-items each subscale: Impulsive Sensation Seeking, Neuroticism–Anxiety, Aggression–Hostility, Activity, and Sociability.

Psychophysiological assessment (physiological recordings)

All physiological data (i.e. scoring of the electrodermal parameters) was recorded with the I-330-C2+ (Mc-6SY temperature/EDR cable sensor) supplied by J&J Engineering. Electrodes were placed on the distal phalanges of the dominant index and ring fingers, and skin conductance responses for each trail were hand scored from individual records. Electrodermal activity (galvanic skin conductance) was recorded in microSiemens (μS) and the skin conductance level variability was measured at the onset of each stimulus. The measure of interest was the amplitude of the participants' skin conductance response (SCR) to each descriptor. Thus, skin conductance is used as an indicator of arousal. The SCRs reflected the phasic changes (that is to say, the increase in conductance equal or superior to 0.02 μS) that occurred in the interval between 1 and 4 seconds after stimulus onset (latency window). The size of the SCR is quantified as the amount of increase in conductance measured from the onset of the response to its peak. Because SCR can be elicited by sighs, deep breaths, and bodily movements we asked participants to avoid them as much as possible during the experimental trial. In an attempt to normalize the distribution of SCRs before they underwent statistical analysis, we conducted a logarithmic transformation to normalize the skewed data (Venables and Christie, 1980). In order to avoid zero logarithms or amplitudes lower than 1 μS

(which would be negative) we added 1 to the SCR amplitude measures (1 + SCRamp). The resulting values were between 0 and 1, so they were multiplied by 1000 so that we did not have to use such small values (Marcos, 1998; Redondo and Méndez, 2011).

Statistical analyses

After the logarithmic transformation, we computed the means and standard deviations of all the variables for descriptive purposes. Then, we conducted statistical parametric tests, such as the Student's t-test (examining group differences in psychological variables, memory recall, and for each word) and a repeated-measures analysis of variance (ANOVA) on each Skin Conductance Response (SCR) with a significance level set at alpha = 0.05 and a Greenhouse-Geyser correction when necessary. Post hoc comparisons were performed to explore the patterns of significance found with the ANOVA. Pearson correlation analyses were also conducted. Data from participants with a non-responsive pattern (N=11) were discarded from all analyses.

RESULTS

Sample

Participants (N=66) were mostly students (79%) and female (n=50; 75%) between 17 and 53 years old ($\bar{X}$= 27 years; SD= 7). Migraineurs (n= 35; 31 females) were between 21 and 53 years old ($\bar{X}$= 30 years, SD= 8.1). A total of 30 (86%) migraineurs had migraine without aura. Headache-free controls (N= 31; 19 females) were between 17 and 38 years old ($\bar{X}$= 24 years; SD= 4).

Pain-related domains

Migraineurs had experienced pain for as little as 5 years and as long as 40 years ($\bar{X}$= 16; SD= 8.21). The usual pain intensity score was in the medium-high range ($\bar{X}$= 7.2; SD= 1.43) and present pain intensity (i.e., pain at the time of the experiment) in the low range ($\bar{X}$= 2.1; SD=

1.33). The HIT-6 revealed that it had a high impact on the individual's ability to function ($\bar{X}$= 60; SD=6.9). Pain episodes lasted for as long as 72 hours ($\bar{X}$=24.17hours; SD= 22.84), and the monthly frequency of pain episodes ranged from 1 to 10 ($\bar{X}$= 3.4; SD= 2.43). The most common migraine pain descriptors were: pressure, pulsing, vomiting and heaviness. In addition, stress, strong/intense emotions (such as sadness and loneliness), sleep changes, weather changes and diet factors were reported as the most usual pain triggers. Sixty-nine per cent of the participants had a family history of migraine and eighty-nine per cent were taking some sort of pain killers. Non steroid anti-inflammatory drugs (NSAIDs) were the most used pharmacological method to get relief from pain. Ibuprofen (NSAIDSs) was used by 21 migraineurs, Paracetamol: 6 migraineurs; Nolotil (metamizol; analgesic and antipyretic): 5 migraineurs, and Topamax (anticonvulsant): 4 migraineurs. Thus, this group of migraineurs seldom engaged in preventive treatments (such as beta adrenoceptor blockers or selective calcium antagonists), relying more on an acute treatment.

Electrodermal activity

Results revealed that migraineurs had higher electrodermal activity for pain descriptors, emotional and neutral words than controls (see Table 1). A 2 x 3 analysis of variance [skin conductance response amplitude with group (migraine and control) as the between-factor and word type (pain descriptors, negative emotional and neutral words) as the within-factor] revealed a highly significant word type effect ($F(1.85, 118.09) = 10.33$, $p = 0.00$). Post hoc comparisons revealed that the skin conductance responses (SCRs) induced by pain descriptors and emotional words were both significantly larger than those induced by neutral words ($F(1.00, 64.00) = 24.36$, $p = 0.0001$; and $F(1.00, 64.00) = 10.63$, $p = 0.002$, respectively) but did not differ from each other. The interaction effect was non significant ($F(1.85, 118.01) = 0.002$, $p = 0.98$). Between-group comparisons showed a nonsignificant statistical effect for

group (F (1.00, 64.00) = 2.50, p = 0.119). Thus, no significant differences emerged between the migraine and headache-free control groups when different types of visual stimuli were displayed.

Table 1. Means and standard seviations (SD) of Skin Conductance Responses (SCRs) induced by pain descriptors, emotional words, and neutral words in migraineurs vs. headache-free controls

Words	Migraine group	Headache-free controls
Pain	260.8 (162.17)	213.93 (116.68)
Emotional	253.99 (168.66)	203.14 (154.77)
Neutral	199.83 (135.16)	152.76 (86.21)

Of the ten pain descriptors "pulsing" was the only one which elicited differences in electrodermal activity between groups (t(64)= 1.98, p= 0.05). Betrayal and loneliness produced significant differences between groups and the largest electrodermal responses were in the migraine group (t(64)= 2.38, p= 0.021; t(64)= 2.08, p= 0.042, respectively). Further, these negative emotional words emerged as notable migraine triggers in our chronic pain sample. None of the neutral words produced statistical differences between the two groups. Furthermore, we studied the relationship between the evoked electrodermal activity of a word and the average electrodermal activity for the rest of the words. However we did not have the opportunity to test a number of (personal) pain descriptors and triggers mentioned by the migraineurs as they were not part of the original list of visual stimuli of the experiment. Thus, statistical analysis focused on the patients who used pain descriptors and triggers that were mentioned and therefore visualized. Words tested were: loneliness, sadness, pressure, scalding, pulsing, pounding, nauseating, and sickening. The words sadness, scalding, nauseating and sickening led to significant differences (see Table 2).

Table 2. Means and standard deviations for pain descriptors and triggers and the mean for all words in the migraine group

Words	Group	Mean	SD	N	t
Loneliness	Word	414.00	224.94	7	1.168
(soledad)	Mean	315.19	200.42	7	
Sadness	Word	752.98	215.97	4	3.120*
(tristeza)	Mean	229.31	122.61	4	
Pressure	Word	405.63	81.39	6	1.252
(opresión)	Mean	340.44	57.76	6	
Scalding	Word	808.15	60.44	2	10.778*
(abrasador)	Mean	357.52	1.32	2	
Pulsing	Word	291.16	325.82	11	0.824
(latidos)	Mean	215.76	114.15	11	
Pounding	Word	288.29	117.69	6	1.024
(martillazos)	Mean	146.15	59.67	6	
Nauseating	Word	624.36	388.85	11	3.644*
(nausea)	Mean	265.53	190.93	11	
Sickening	Word	669.13	407.03	6	2.850**
(mareo)	Mean	245.33	113.15	6	

* p= 0.05; ** p< 0.05

Mean scores were obtained by calculating the mean for the rest of words

N: number of participants who used the pain descriptors and triggers.

Memory recall

Overall, there were no significant differences in memory recall (delayed) between migraineurs and headache-free control groups when exposed to different types of visual stimuli (i.e. pain, negative emotional and neutral words). However, when participants were asked to recall the words immediately after the experiment, migraineurs recalled significantly more emotional words than controls ($t(62)= 2.28$, $p = 0.026$) (see Table 3). Correlations between memory recall (both immediate and delayed) and psychological variables (i.e. anxiety, depression, and pain catastrophizing) are presented in Table 4. Catastrophic thinking

was positively and significantly correlated with total- and emotional-word recall (both immediate and delayed).

Table 3. Mean rating scores (standard deviation) for memory recall of words after the experiment (immediate) and following an interference task (delay) in the migraine and control groups

Groups	**Immediate recall** Mean(SD)				**Delayed recall** Mean(SD)			
	Total words	Pain words	Emotional words*	Neutral words	Total words	Pain words	Emotional words	Neutral words
Migraine group	11 (3.69)	3 (2.04)	5 (1.71)	3 (1.52)	12 (3.53)	4 (1.84)	5 (1.68)	3 (1.37)
Control group	10 (3.14)	3 (2.07)	4 (1.55)	2 (1.80)	11 (2.84)	3 (2.08)	4 (1.62)	3 (1.75)

*** p < 0.05**

Table 4. Correlation between memory recall of words after the experiment (immediate) and following an interference task (delay) and psychological variables

Psychological Variables	**Immediate recall**				**Delayed recall**			
	Total words	Pain words	Emotional words	Neutral words	Total words	Pain words	Emotional words	Neutral words
Anxiety	r=0.13	r=0.13	r=0.19	r=-0.10	r=0.08	r=0.04	r=0.13	r=-0.03
Depression	r=-0.09	r=0.01	r=-0.01	r=-0.19	r=-0.05	r=-0.06	r=-0.01	r=-0.027
Pain catastrophizing	r=0.35**	r=0.19	r=0.27*	r=0.24	r=0.34**	r=0.19	r=0.29*	r=0.16

*** p < 0.05; ** p< 0.01**

Psychological domains

There were significant differences in the psychological variables (see Table 5) and personality dimensions between migraine and control groups. Migraineurs scored significantly

higher on anxiety (t(62)= 4.43,p = 0.00) and pain catastrophizing (t(63)= 5.05, p = 0.00), and presented higher levels on the personality dimensions of activity (t(63)= 2.25, p = 0.018), aggression-hostility (t(63)= 3.24, p = 0.002), and neuroticism-anxiety (t(63)= 4.10, p = 0.00) than headache-free controls. Controls scored significantly higher on the sociability personality dimension (t(63)= -2.14, p= 0.036) than migraineurs.

Table 5. Means and standard deviations for psychological domains in migraineurs *vs*. headache-free controls

Psychological domains	Migraine group	Headache-free controls	t
Anxiety	9.23 (3.47)	5.59 (3.02)	4.43**
Depression	3.23 (2.71)	2.28 (2.53)	1.29
Pain Catastrophizing	30.46 (11)	17.10 (10.18)	5.05**
Activity	5.66 (2.40)	4.30 (2.05)	2.25*
Aggression-hostility	5.20 (2.70)	3.07 (2.59)	3.24**
Neuroticism-anxiety	4.66 (2.49)	2.23 (2.22)	4.1***
Social-desirability	5.26 (2.38)	6.50 (2.27)	-2.14*

*** p < 0.01; ** p < 0.005; *** p < 0.001**

DISCUSSION

As hypothesized, the results of this study show that electrodermal activity and memory recall depend on the type of stimuli (i.e. pain, negative emotional and neutral) in migraine patients. It also documents the relevance of emotional and cognitive states in migraineurs' pain. Memory recall was found to be related to pain catastrophizing, while migraineurs significantly recalled more emotional stimuli compared to headache-free controls, at least for immediate recall.

These findings are in agreement with previous published studies that show that in chronic pain patients the skin conductance responses (SCRs) induced by pain descriptors are larger than those induced by neutral words (Flor et al., 1997; Bonnet and Naveteur, 2006;

Chapman and Martin, 2011). In this study, emotional stimuli also induced larger electrodermal responses than neutral stimuli, as indicated in some previous published studies (Greenwald et al., 1989; Lang et al., 1993; Bradley et al., 1996). The SCRs induced by negative emotional words were as large as those induced by pain descriptors. These findings are in line with previous published works (e.g. Bonnet and Naveteur, 2006). However, and contrary to our first hypothesis, the results did not confirm a specific electrodermal sensitization to pain-related stimuli nor to negative emotional stimuli in our sample of migraineurs. The failure to demonstrate greater reactivity to pain descriptors may be due to a number of methodological limitations. First, our sample of participants was small, which may have precluded finding small but potentially statistically significant differences. Second, the pain descriptors used in this study, although migraine-related, may not be relevant to all migraineurs. The subject-rated emotionality of words is an important element in the elicitation of skin conductance responses (Campos et al., 1999). In our study, only 'pulsing' emerged as an important pain descriptor and there were significant differences between migraineurs and headache-free controls. When pain descriptors and triggers used by migraineurs were analysed, specific differences emerged when compared to the other words. A number of (personal) pain descriptors and triggers mentioned by migraineurs could not be compared as they were not part of the original list of visual stimuli of the experiment, that was the case of vomiting or stress (the trigger mentioned the most). One of the main problems in psychophysiological pain assessments is the use of test stimuli that may not be relevant for the patient being tested (Flor and Meyer, 2011). Future studies should profitable examine these triggers as they seem to be strongly linked to migraine pain. Third, even though the negative emotional words in this study were not pain descriptors, they were not completely unrelated to physical pain as illustrated by the pain ratings of the emotional words in the pilot study. Finally, although we used already proven procedures for the selection of our word lists, it could be questioned whether they are really representative or not.

Our second hypothesis was partially supported. That is, the recall of negative emotional words was significantly different between experimental groups: migraineurs immediately recalled more emotional words than headache-free controls. This is also in line with previous studies showing that words whose emotional content is congruent with the patient's pain status and emotional state may be more likely to be remembered (Asmundson et al., 1997; Keogh et al., 2001; Pearce et al., 1990). The migraineurs in the present study were significantly more anxious and greater pain catastrophizers than headache-free controls. Although, both variables resulted in significant differences between the groups, only pain catastrophizing was related to memory recall, which gives support to our prediction about the relationship between memory recall, and pain fear cognitions (i.e. catastrophic thinking). Pain catastrophizing, which has been associated in our study with anxiety and recall of emotional words, has demonstrated to be a strong predictor of chronic pain associated with anxiety and pain vigilance in people with chronic pain (Roelofs et al., 2002; Goubert et al., 2004). Further, anxiety states have shown to be associated with increased attention to threat and negative stimuli (e.g., Mathews and Mackintosh, 1998; Rutherford et al., 2004). Emotional stimuli and emotional states, such as negative affect, are major migraine triggers (Puschmann and Sommer, 2011) that can influence attention and memory processes. Pain-related negative affect has sensitizing and disabling effects since it can cause ongoing physiological reactivity and hypervigilance to pain (Janseen, 2002). Predisposition and learning mechanisms might be the basis for a habitual pattern of reactivity to pain, including avoidance behaviour, cognitive preoccupation with bodily signals and heightened physiological arousal that becomes increasingly chronic (Evers et al., 2001).

To the best of our knowledge, this is the first empirical investigation with a controlled group to examine the specificity of psychophysiological response to pain descriptors (including negative emotional and neutral words) in migraineurs. Despite the limitations of the study, our findings provide additional evidence that in migraine not only pain-related but negative

emotional stimuli may pose a threat to patients. Emotional words may be leading to memory biases in migraine patients. Repeated exposure to the same pain stimulus may be responsible, in part at least, of the development of a strong, sustained emotional state. The importance of emotional triggers (Andress-Rothrock et al., 2010; Puschmann and Sommer, 2011) and their link to migraine may explain why migraineurs are susceptible not only to pain but also to negative emotional stimuli. It has been argued that individuals with migraine associate their attacks to trigger factors, which over time become a threat to them (Puschmann and Sommer, 2011). Avoidance of personal trigger factors may explain the process of migraine chronification since it increases sensitivity to the triggers and leads to an increased probability of migraine attacks in response to triggers (Martin and MacLeod, 2009). Therefore, headaches can be maintained or increased through a process of sensitization, failed habituation or lack of opportunity to learn to cope with the trigger (Martin and MacLeod, 2009). On the other hand, our data may also be the result of a general emotional susceptibility because the acute perception of threat or trauma causes fear, which can increase pain perception by enhancing electrodermal activity or other psychophysiological activities (Wickramasekera, 1995). Buttler and Moseley (2003) suggested that when pain is chronic, it hurts because the brain has somehow concluded that the individual is threatened and in danger. So migraine may be perceived by the brain as a threat to the integrity of the body, thus activating a danger alarm system and a specific memory network (Pires, 1990). The brain deals not with reality, but with an external representation of reality that it constructs from moment to moment using sensory information, networks of association and memory stores (Chapman et al., 1999). Furthermore, many of the information processing and physiological responses are initially unconscious, and produce affective changes and subsequent awareness of emotional arousal (Chapman and Nakamura, 1999).

If replicated, these findings have important implications for understanding and intervening in migraine pain. Interventions could aim to target problematic pain-related

memories that influence the perception of migraine pain and pain-related physiological responses (Rainville et al., 2005). Pain-increasing mechanisms, such as autonomic and muscular reactivity, hypervigilance to pain, and avoidance behaviour should be taken into account as they might play a relevant role in the process of migraine chronification.

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Author contribution

Both authors contributed to conception and development of the original idea and participated in the different drafts and discussed the results, and approved the final version.

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Tables – Supplementary material

Table-Supplementary 1. Mean rating scores (SD) for each type of word in migraineurs vs. headache-free controls

Table- Supplementary 2. Final list of pain, emotional (negative) and neutral words used in the study

SUPPLEMENTARY MATERIAL

The words were selected using the following criteria: (a) frequency ratings should be comparable between word types; (b) the pain-related words should have high pain-related ratings; (c) the negative emotional words should have high emotional-related ratings, and (d) the neutral words should have low pain- and emotional-related ratings. Finally, we consulted the Spanish adaptation of ANEW (Affective norms for English words; Redondo et al., 2007) that gave additional information regarding the valence, arousal and dominance of the selected words. The ANEW program also gave information about the frequency and familiarity of words, which we also checked using the program Busca-Palabra (B-Pal, a program for deriving orthographic and phonological neighbourhood statistics and other psycholinguistic indices in Spanish [Davis and Perea, 2005]).

There were no significant effects of word type or group on the frequency of use [$F(1.19, 19.09)= 3.34$, $p= 0.077$; $F(1.00,16.00)= 0.82$, $p= 0.378$, respectively]. There was a significant interaction between word type and group [$F(1.19, 19.09)= 4.29$, $p= 0.046$], although post hoc comparisons found no significant differences between groups and word type. On the emotional scale, word type had a significant effect [$F(1.93, 30.83)= 44.67$, $p= 0.00$], and the interaction between word type and group reached statistical significance [$F(1.93, 30.83)= 3.74$, $p= 0.037$]. Significant differences were found between pain descriptors and neutral words [$F(1.00, 16.00)= 7.47$, $p= 0.015$], emotional words and neutral words [$F(1.00, 16.00)= 88.57$, $p= 0.00$], and finally, pain descriptors and emotional words [$F(1.00, 16.00)= 46.46$, $p= 0.00$]. Therefore, pain descriptors scored higher on the emotional scale than neutral words, whereas emotional words scored higher than neutral words and pain descriptors (see Table – supplementary- 1). With neutral words, migraineurs scored significantly higher on the emotional scale than controls [$F(1.00, 16.00)= 6.85$, $p= 0.029$]. No significant effect of the group emerged, so there were no differences between the groups in the use of this scale. For the pain scale, word type was found to have a significant effect [$F(1.95, 31.18)= 109.06$, $p=$

0.00]: pain descriptors scored higher than neutral words on the pain scale [F(1.00, 16.00)= 102.90, p= 0.00], whereas emotional words scored higher than neutral words [F(1.00, 16.00)= 237.34, p= 0.00] and also pain descriptors [F(1.00, 16.00)= 11.37, p= 0.004] on the same scale. There was no interaction between word type and group (F(1.95, 31.18)= 0.57, p= 0.567].

Table-Supplementary 1. Mean rating scores (SD) for each type of word in migraineurs *vs*. headache-free controls

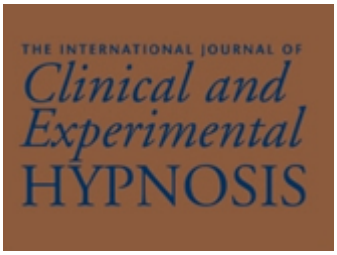
Scales	Pain descriptors	Emotional words	Neutral words
Pain scale	5,52 (1,55) *vs*. 5,56 (1,07)	7,29 (0,92) *vs*. 6,50 (1,37)	1,44 (1,46) *vs*. 1,18 (1,05)
Emotional scale	5,10 (1,52) *vs*. 5,03 (1,30)	7,85 (0,92) *vs*. 7,91 (0,76)	4,80 (1,81) *vs*. 2,67 (1,59)
Frequency scale	3,52 (1,35) *vs*. 4,47 (1,07)	4,27 (1,64) *vs*. 5,48 (1,11)	4,56 (1,18) *vs*. 3,83 (1,83)

Table Supplementary 2. Final list of pain, emotional (negative) and neutral words used in the study

Pain words	Emotional words	Neutral words
Throbbing (palpitante)	Sadness (tristeza)	Autograph (autógrafo)
Cramping (calambrazos)	Corpse (cadáver)	Echo (eco)
Sickening (mareo)	Loneliness (soledad)	Glossary (glosario)
Nauseating (nausea)	Putrefaction (putrefacción)	Volley (voleibol)
Pressure (opresión)	Hate (odio)	Semester (semestre)
Numbing (hormigueo)	Betrayal (traición)	Analogy (analogía)
Stabbing (punzante)	Terror (terror)	Delegation (delegación)
Scalding (abrasador)	Loss (pérdida)	Analytic (analítico)
Pulsing (latidos)	Death (muerte)	Mirror (espejo)
Pounding (martillazos)	Anguish (angustia)	Wardrobe (armario)

Note. Spanish words were used in our study. Here we provide the English translation to facilitate comprehension.

2. Study II: Hypnosis for the management of chronic and cancer procedure-related pain in children



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HYPNOSIS FOR THE MANAGEMENT OF CHRONIC AND CANCER PROCEDURE-RELATED PAIN IN CHILDREN[1]

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Abstract: The aim of this study was to review published controlled trials of hypnotic treatments for chronic and cancer procedure-related pain in children. Trials were included if participants were 18 years of age or below, were randomized and had populations with chronic pain or cancer procedure-related pain. After the studies were assessed, 12 were selected for review. Although the evidence is limited, the findings indicate that hypnosis is an effective pain-control technique when used with children suffering from cancer procedure-related pain or chronic pain. Further research into the use of hypnosis to manage chronic pain in children should be a priority so that empirically based conclusions can be drawn about the effects of hypnosis on children.

Hypnosis has been conceptualized as a technique that usually contains an induction or introduction procedure "during which the subject is told that suggestions for imaginative experiences will be presented" (Green, Barabasz, Barrett, & Montgomery, 2005, p. 262). This inductive procedure is followed by suggestions "for changes in subjective experience, alterations in perception, sensation, emotion, thought, or behavior" (Green et al., 2005, p. 262). There are usually three components: (a) absorption, focused concentration; (b) dissociation, relative suspension of peripheral environment; and (c) hypnotizability.

Published reports, systematic reviews, and meta-analyses have demonstrated that hypnosis can be used effectively to manage pain in adults for acute, chronic, or cancer procedure-related pain experiences (Eitner, Sokol, Wichmann, Bauer, & Engels, 2011; Elkins, Koep, &

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Kendrick, 2012; Facco et al., 2011; Hammond, 2007; R. M. F. Hawkins, 2001; Huet, Lucas-Polomeni, Robert, Sizou, & Woody, 2011; Jensen et al., 2011; Jensen & Patterson, 2006; Lew, Kravits, Garberoglio, & Williams, 2011; Lynn, Kirsch, Barabasz, Cardeña, & Patterson, 2000; Montgomery, DuHamel, & Redd, 2000; Nusbaum et al., 2011). Similarly, in young patients, a number of controlled (Kellerman, Zeltzer, Ellenberg, & Dash, 1983; Olness, MacDonald, & Uden, 1987; Vlieger, Menko-Frankenhuis, Wolfkamp, Tromp, & Benninga, 2007), noncontrolled (Anbar, 2001a, 2001b; Anbar & Zoughbi, 2008; Galili, Shaoul, & Mogilner, 2009; Kapelis, 1984; Kohen & Zajac, 2007; Waterhouse, Powers, Levy, & Zeltzer, 2000; Zeltzer et al., 2002), and case studies (Olness & MacDonald, 1981) have found evidence of the positive effects of using hypnosis as a single or combined intervention on children's pain problems (e.g., the reduction in pain intensity, frequency, and duration of pain episodes) (Milling & Costantino, 2000; Smith, Barabasz, & Barabasz, 1996). Recent findings in the domain of hypnosis and pain (e.g., how clinical practices and hypnosis can be used to manage pain in children) support the therapeutic benefits of hypnosis (Wood & Bioy, 2008).

Although there is a great deal of robust data that shows the efficacy of hypnosis in the management of pain (Elkins et al., 2007; R. M. F. Hawkins, 2001; E. R. Hilgard & Hilgard, 1995), very little is known about the underlying mechanisms. It has been suggested that hypnotizability is a predictor of positive treatment outcomes (Jensen & Patterson, 2006). Moderate-to-high hypnotizability has been reported to be associated with improvements in pain after hypnotic treatment (J. R. Hilgard & LeBaron, 1982; Liossi & Hatira, 1999; Montgomery et al., 2000). Nevertheless, this is a controversial issue. For example, some researchers argue that it is of clinical importance (e.g., Smith et al., 1996), while others claim that it is not or even suggest that it can interfere with therapeutic results (e.g., Pires, Mendonza, & Capafons, 2009; Yapko, 2003). To date, no studies have systematically explored this controversial issue so an evidence-based solution has yet to be provided.

In the field of pediatric pain, no papers have been published on the specific components of the treatments that are implemented (e.g., different inductions or suggestions, number or length of treatment sessions). Therefore, the components that are similar, the same, or different in the various hypnotic protocols still need to be specifically assessed. An analysis of the components of hypnotic protocols used with children and adolescents would be of great assistance to clinicians when they have to take decisions about which protocol is the most appropriate for a particular patient and under what circumstances.

The objective of our review is to evaluate those randomized controlled trials that have been published on hypnotic analgesia for managing chronic and cancer procedure-related-pain problems in

children and adolescents. In this analysis, we will specifically focus on two unexplored issues: (a) the effect that hypnotizability has on the results of hypnosis and (b) the components that make up the successful hypnotic protocols that have been published on the management of pediatric pain.

Method

A search was conducted for published, randomized controlled trials (RCTs) on the use of hypnosis for treating chronic and cancer procedure-related pain in children. In this study, the generic term *children* is used to refer to individuals 18 years old or younger. The key words were *children*, *hypnosis*, and *pain*, and they were combined to identify the relevant literature. The line between hypnosis and other interventions, such as relaxation or imagery, is blurred (Patterson, 2004) and there is still some controversy concerning what an intervention must include if it is to be labeled hypnosis (Jensen & Patterson, 2006). In order to use a common criterion across studies, we selected only those that labeled their intervention as hypnosis.

In our search procedure, we made some a priori decisions: namely, to search only for papers (a) reported in full (complete articles and not just the abstract), (b) published in Catalan, English, French, Portuguese, or Spanish and (c) printed in peer-reviewed journals. For the studies to be included in the review, the samples had to include patients 18 years of age or younger suffering from any of the following problems: headache, juvenile rheumatoid arthritis, fibromyalgia, cancer pain, low back pain, temporomandibular pain disorders, recurrent abdominal pain, disability-related pain, recurrent pain, or mixed chronic pain. The strategy followed was similar to that implemented by previous reviews of a similar nature (e.g., Palermo, Eccleston, Lewandowski, Williams, & Morley, 2010). Studies that were not RCTs were excluded from this review. First, we electronically searched Medline from 1951 to May 2009, PsycINFO from 1987 to May 2010, and the Cochrane Library database. This search yielded 81 papers of which 27 were identified as trials of interest. After close examination, 12 of them were considered to be relevant to our objectives (only RCTs). Second, we reviewed the reference lists of the 12 randomized controlled trials to find other relevant trials on this matter, but no additional papers were identified. We report the effect sizes for those studies in which enough detailed data was available for calculation. To make effect sizes comparable between studies, we only report on pre- to posttreatment effect sizes for measures of pain intensity. Cohen (1988) interprets effect sizes of .20 to be "small," .50 to be "medium," and .80 or above to be "large." An effect size of .20 or above is considered to be clinically meaningful (Liossi, White, & Hatira, 2009).

Results

A total of 12 randomized controlled trials (RCTs) were included in this review: one on migraine (Olness et al., 1987), one on functional abdominal pain and irritable bowel syndrome pain (Vlieger et al., 2007), and 10 related to cancer procedure-related pain management (P. J. Hawkins, Liossi, Ewart, Hatira, & Kosmidis, 1998; Katz, Kellerman, & Ellenberg, 1987; Kuttner, Bowman, & Teasdale, 1988; Liossi & Hatira, 1999, 2003; Liossi, White, & Hatira, 2006; Liossi et al., 2009; Smith et al., 1996; Wall & Womack, 1989; Zeltzer & LeBaron, 1982).

First, we will summarize the trials reviewed. We present the results by grouping the studies according to the control conditions that were implemented, a strategy that enables the effectiveness of hypnosis to be properly examined, and one that has already been successfully used in previous reviews on hypnosis (Jensen & Patterson, 2006). In order not to repeat the information, we present the primary findings of each study when it is first mentioned. The tables in this review include extra information about the outcomes assessed and controlled trials (Table 1) and the hypnotic interventions used in each study (Table 2). Second, we will focus on the evidence that suggests that hypnotizability is a predictor of outcomes. Finally, we will look at the content of hypnotic interventions (component analyses). All the hypnotic interventions were performed individually.

Randomized Controlled Trials Using Hypnosis in the Management of Chronic and Cancer Procedure-Related Pain in Children: A Summary of Results

Hypnosis compared to baseline control. Four of the 12 studies assessed outcomes during a no-treatment baseline period (P. J. Hawkins et al., 1998; Liossi & Hatira, 2003; Olness et al., 1987; Zeltzer & LeBaron, 1982). The baseline control experimental condition involves assessing the treatment outcome variables at least twice before treatment begins. All four studies had a baseline period or a multiple baseline design that enabled the outcome variables to be compared. Three articles focused on the use of hypnosis to manage cancer procedure-related pain (bone marrow aspiration and lumbar puncture) (P. J. Hawkins et al., 1998; Liossi & Hatira, 2003; Zeltzer & LeBaron, 1982), and one article on headache pain (migraine) (Olness et al., 1987). All studies reported hypnosis to be more effective at managing pain than the baseline control condition (i.e., the absence of treatment).

P. J. Hawkins and colleagues (1998) compared 30 children with cancer in two types of hypnotic interventions (direct vs. indirect suggestions) and found a statistically significant reduction with respect to baseline in pain, anxiety, and observed distress during lumbar puncture (LP) in both groups. Both treatments were found to be equally effective and the level of hypnotizability was significantly related to the size of the

Table 1
Randomized Controlled Trials Using Hypnosis in the Management of Pediatric Chronic and Cancer Procedure-Related Pain

Author(s)/Date/ Location	Diagnosis (*n*)/Age of Participants	Experimental Conditions	Outcome Dimension(s); Process Variables	Assessment Points
CHRONIC PAIN				
Olness et al. (1987) Minneapolis, USA	Migraine headache (28) (6–12 years old)	G1: Placebo-placebo-self-hypnosis ($n = 9$) G2: Propranolol-placebo-self-hypnosis ($n = 11$) G3: Placebo- propranolol-self-hypnosis ($n = 8$) G4: baseline Individual hypnosis	(1) Headache pain (frequency, intensity, and severity) No process variables assessed	(1) Pre-HYP tx (baseline; 4-week); (2) After-HYP tx
Vlieger et al. (2007) Amsterdam, Netherlands	Functional abdominal pain (31) and irritable bowel syndrome (22) (8–18 years old)	G1: Hypnosis (gut-directed HYP) – HYP ($n = 28$) G2: Standard medical therapy – SMT ($n = 25$) Individual hypnosis	(1) Abdominal pain (frequency and intensity, 7-day *Pain Diary Card)*; (2) associated symptoms (7-day *Pain Diary Card)*; (3) Headache pain intensity (*Pain Diary*) No process variables assessed	(1) Pre-tx (baseline); (2) during-tx (weeks 1, 4, 8 and 12); (3) after-tx: follow-up (6 and 12 months)

CANCER PROCEDURE-RELATED PAIN				
P. J. Hawkins et al. (1998) Athens, Greece	Cancer pain (30) (6–16 years old)	G1: Direct hypnosis (HYP) G2: Indirect HYP G3: Baseline Individual hypnosis	(1) Pain (*Wong-Baker Faces scale*); (2) anxiety (*Wong-Baker Faces scale*); (3) observed distress (*PBCL-Children*); (4) Process variable assessed: hypnotizability susceptibility (*SHCS-Children*)	(1) Pre-tx (baseline: during LPs); (2) After-tx (during the 1st LP in which HYP was used)
Katz et al. (1987) Los Angeles, USA	Cancer pain (36) BMA (6–12 years old)	G1: Hypnosis ($n = 17$) G2: Play ($n = 19$) Individual hypnosis	(1) Fear (Fear self-report: *Fear-SR*); (2) Pain (self-reported *Pain-SR*); (3) Observed distress (*PBRS-r*); (4) Anxiety (nurse rating); (5) Process variables assessed: Rapport ratings (therapist rating, after each pre-bone marrow aspiration (BMA) intervention session in both interventions) and Response to HYP (therapist rating; after each hypnotic intervention)	(1) Pre-tx (baseline); (2) After-tx (3 BMAs)

(*Continued*)

Table 1
(*Continued*)

Author(s)/Date/ Location	Diagnosis (*n*)/Age of Participants	Experimental Conditions	Outcome Dimension(s); Process Variables	Assessment Points
Kuttner et al. (1988) Vancouver, Canada	Cancer pain (48[a]) BMA/L (3–10 years old) [a]48 - baseline and first tx session ; 30 of these 48 - second tx 2 age groups: 3 to 6 years old (younger group); and 7 to 10 years old (older group)	G1: Hypnosis (*imaginative involvement*) G2: Behavioral distraction G3: Standard medical practice (SMP) Individual hypnosis	(1) pain intensity – *Observer Rating Scale* and *Self-rating of pain* ; (2) anxiety (*Observer Rating Scale* and *Self-rating of anxiety)*; (3) observed distress (*The Procedure Behavior* Rating Scale *Revised*); No process variables assessed	(1) Pre-tx (baseline); (2) After-tx (1st and 2nd interventions)
Liossi and Hatira (1999)	Cancer pain (30) BMA (5–15 years old)	G1: Hypnosis (HYP) ($n = 10$) G2: Cognitive-behavioural coping skills ($n = 10$) G3: Standard medical therapy (SMT) ($n = 10$) Individual hypnosis	(1) Pain; (2) anxiety (*Self-rating of pain and anxiety*); (3) observed distress (*Procedure Behavior Checklist*); (4) process variable assessed: hypnotic ability (*Stanford Hypnotic Clinical Scale for Children- SHCS-CHILD*)	(1) Pre-tx (baseline; during 1 BMA); (2) After-tx (during 1 BMA)

Liossi and Hatira (2003) Athens, Athens, Greece	Cancer pain LP (80) (6–16 years old)	G1: Direct hypnosis (HYP) + standard medical treatment (SMT) ($n = 20$) G2: Indirect HYP + SMT ($n = 20$) G3: Attention control + SMT ($n = 20$) G4: SMT alone ($n = 20$) G5: Baseline Individual hypnosis	(1) pain; (2) anxiety (*Self-rating of pain and anxiety* on the Wong-Baker Faces scale: 0–10; (3) observed distress (*Procedure Behavioral Checklist*); (4) Process variable assessed: hypnotic ability (SHCS-children; Greek version)	(1) Pre-tx (baseline; during 3 consecutive LPs); (2) After-tx (during 2 consecutive LP with intervention); (3) After-training self-HYP (during 1st, (during 1st, 3th and 6th sessions)
Liossi et al. (2006) Athens, Greece	Cancer pain (45) (6–16 years old)	G1: EMLA cream ($n = 15$) G2: EMLA cream + HYP ($n = 15$) G3: EMLA cream + attention control ($n = 15$) Individual hypnosis	(1) Anticipatory anxiety and (2) procedure-related pain and anxiety (*Wong-Baker Faces* Pain Rating *scale*); (3) observed distress (*PBCL*); (4) process variable assessed: hypnotic susceptibility (*SHCS-Children*; Greek version)	(1) Pre-tx (baseline/Time 1: during 1 LP; (2) After-tx (Time 2: during the 1st LP using interventions); (3) After-training (Times 3 and 4: during the 1st and 6th LP in which self-hypnosis was used.)

(*Continued*)

Table 1
(*Continued*)

Author(s)/Date/ Location	Diagnosis (*n*)/Age of Participants	Experimental Conditions	Outcome Dimension(s); Process Variables	Assessment Points
Liossi et al. (2009) Athens, Greece	Cancer pain (45) VP (7–16 years old)	G1: EMLA[a] cream ($n = 15$) G2: EMLA cream + HYP ($n = 15$) G3: EMLA cream + attention control ($n = 15$) [a]eutectic mixture of local anaesthesia Individual hypnosis	PATIENTS: (1) Procedure-related pain (*VAS*); (2) procedure-related anxiety (*VAS*); (3) observed behavioral distress (*PBCL-Children*); PARENTS: (1) anxiety (*VAS*) No process variables assessed	(1) After-tx (Time 1: b1-during a venipuncture immediately following interventions; b2-parents were assessed during their child´s venipuncture); Time 2, 3: c1- during follow-up venepunctures; Time 3: c2- parents were assessed during their child's second follow-up venepuncture
Smith et al. (1996) Washington, USA	Cancer pain and blood disorders (27) (3–8 years old)	G1: Hypnosis (HYP) ($n = 14$) G2: Distraction ($n = 13$) Individual hypnosis	(1) Pain, and (2) anxiety (Children's Global Rating Scale- *CGRS*); (3) observed-reported anxiety; (4) observed behavior distress (*OSBC-R*); parents: (5) pain and anxiety (5-point Likert); (6) skin conductance responses (*SCR*); (7) process variable assessed: hypnotic ability *SHCS-CHILD);*	(1) Pre-tx (baseline); (2) After-tx

Wall & Womack (1989) Washington, USA	Cancer patients (20) BMA/LP (5–18 years old) 2 age groups: 5 to 11 years old (younger group); and 12 to 18 years old (older group)	G1: Hypnosis (HYP) ($n = 11$) G2: Active cognitive strategy (distraction) ($n = 9$) Individual hypnosis	(1) Pain, and (2) anxiety (self-rated: anticipatory anxiety, procedural anxiety), and procedural pain: *VAS*; two forms of *STAI*, *MPQ*; (3) observer rating: procedural pain and anxiety (*VAS*); (3) imaginative involvement (interview); (4) heart rate and peripheral temperature; (5) process variable assessed: hypnotizability (*SHCS*)	(1) Pre-tx (during a BMA or LP); After-tx (2nd BMA)
Zeltzer and LeBaron (1982) Texas, USA	Cancer pain (33) BMA/LP (6–17 years old)	G1: Hypnosis (HYP) ($n = 16$) G2: Distraction (nonHYP) ($n = 17$) G3: Baseline Individual hypnosis	(1) Pain: self-rated-scale of 1 to 5; (2) anxiety: self-rated- scale of 1 to 5	1) Pre-tx (baseline); during 1-3 BMA or 1-3 LP or both); 2) After-tx (during subsequent 1-3 BMA or LP or both)

Note. BMA = bone marrow aspiration; LP = lumbar puncture; VP = venipuncture.
[a]We only include the results that proved to be statistically significant.

Table 2
Characteristics of Published Hypnotic Protocols in the Management of Pediatric Chronic and Cancer Procedural-Related Pain

Authors	Hypnotic Protocols	Sessions (Nº, tx Time, Practice)
CHRONIC PAIN		
Olness et al. (1987)	Standard progressive relaxation exercise, imagery, hypnotic suggestions	12 weeks of hypnosis tx; 3 sessions of hypnosis 2 review visits took place at 1-month interval; children were instructed to practice hypnosis twice daily at home
Vlieger et al. (2007)	General relaxation, hypnotic suggestions, ego-strengthening suggestions	6 sessions of 50 minutes over a 3-month period for the hypnosis group; children received a CD to listen or practice hypnosis daily
CANCER PROCEDURE-RELATED PAIN		
P. J. Hawkins et al. (1998)	*Hypnosis – Direct suggestions:* hypnotic induction (by visual imagery), direct hypnotic suggestions (analgesia and anesthesia); *Hypnosis – Indirect suggestions* (Sun and Mexican Food therapeutic metaphors); No attempt was made to give self-hypnosis training	1 session of tx
Katz et al. (1987)	Hypnotic induction (eye fixation with or without eye closure), active imagery, deep muscle relaxation, and hypnotic suggestions (coping with sensory aspects), posthypnotic suggestions	2 sessions of 30 minutes; immediately prior to each participant's bone marrow aspiration procedure after baseline, participants were seen for a 20-minute ("booster") intervention

Kuttner et al. (1988)	A combination of hypnotic suggestions (time reduction and analgesia), imaginative (imagery and fantasy) and therapist support; ego-strengthening suggestions	2 sessions (preparation phase took place involvement between 5–20 min, and during the medical phase
Liossi and Hatira (1999)	Induced by relaxation and visual imagery, progressive muscle relaxation and an abbreviated form of autogenic relaxation, hypnotic suggestions (numbness and anaesthesia), posthypnotic suggestion	2 sessions; 30 minutes each
Liossi and Hatira (2003)	*Hypnosis – Direct suggestions*: hypnotic induction (by ideomotor techniques), direct hypnotic suggestions (analgesia), posthypnotic suggestion, imagery, and ideomotor techniques; *Hypnosis - Indirect suggestions*: hypnotic induction, indirect hypnotic suggestions, posthypnotic suggestions	1 session, 40 minutes; one 45-minute session of self-hypnosis was conducted for both hypnosis group
Liossi et al. (2006)	Hypnotic induction, hypnotic suggestions (analgesia), posthypnotic suggestions	1 session, 40 minutes; one 45-minute session of self-hypnosis
Liossi et al. (2009)	Hypnotic induction, hypnotic suggestions (analgesia), posthypnotic suggestion, imagery, and ideomotor techniques	1 session, 15 minutes; one single 15-minute session of self-hypnosis

(*Continued*)

Table 2
(*Continued*)

Authors	Hypnotic Protocols	Sessions (Nº, tx Time, Practice)
Smith et al. (1996)	Hypnotic induction (favorite place), imaginative involvement (imagery and fantasy), arm levitation suggestion, coping suggestions	Audiotapes of the 3-step procedure was given to parents; children practiced the intervention daily for 1 week before painful medical procedure
Wall and Womack (1989)	Hypnotic induction, progressing from relaxation to imagery, arm levitation suggestion	2 sessions; a tape was given, serving as a cue, to use techniques learned during sessions; tape and headphones were removed prior to preparation of subjects for bone marrow aspiration or lumbar puncture
Zeltzer and LeBaron (1982)	Imagination-focus therapy - imaginative involvement, deep breathing	Patients received tx at different times during the study

therapeutic outcome. The effect sizes and reduction in pain intensity between baseline and posttreatment were 3.20 and 53% for direct hypnosis groups and 3.32 and 55% for indirect hypnosis groups. Liossi et al. (2009) included a standard medical treatment (SMT) as a control condition in a study conducted with 80 children suffering from cancer and undergoing regular lumbar punctures (LPs). Participants were divided into four groups: (a) hypnosis - direct suggestions, (b) hypnosis – indirect suggestions, (c) attention control, and (d) SMT. Because medical management was undertaken by all groups, it appeared that SMT alone was not more effective than the other procedures. In fact, the participants in the hypnosis groups reported less pain, less anxiety, and less observed behavioral distress than those in the control groups. Both hypnosis groups were equally effective. Nevertheless the level of hypnotizability was significantly and positively associated with treatment benefits. Moreover, the therapeutic effects decreased when patients were switched to self-hypnosis. The effect sizes and percentage of change in pain intensity between baseline and hypnosis were as follows: (a) direct hypnosis: 3.71 and 57%; (b) indirect hypnosis: 4.5 and 58%. On the other hand, the effect sizes and percentage of change in pain intensity when patients were switched to self-hypnosis were: (a) direct hypnosis: 2.42% and 37% and (b) indirect hypnosis: 3 and 39.2%. The SMT group showed an effect size of 0.16 and a slight increase in pain intensity (−2.2%).

In another study, Olness et al. (1987) conducted a prospective double-blind, single crossover comparison of placebo and propranolol treatments with hypnosis in the management of juvenile migraine (i.e., placebo-placebo-self-hypnosis, propranolol-placebo-self-hypnosis, and placebo-propranolol-self-hypnosis). This study included a 4-week baseline period, a 1-week period to begin placebo or propranolol, a 10-week placebo or drug treatment period (Period 1), and a 1-week washout period followed by a similar 12-week treatment period (Period 2). After Period 2, all 28 children learned self-hypnosis and were followed for 12 weeks (Period 3). They found that hypnosis significantly reduced the number of headaches but did not decrease intensity or severity of pain. Neither propranolol nor hypnosis, however, had any significant effect on the subjective and objective measures of headache severity.

Finally, Zeltzer and LeBaron (1982) investigated children with cancer and compared hypnosis with distraction interventions. They found that during bone marrow aspiration (BMA) pain was reduced to a large extent by hypnosis and to a smaller but still significant extent by distraction. However, anxiety was significantly reduced by hypnosis alone during BMA. During lumbar puncture, only hypnosis significantly reduced pain, and anxiety was reduced to a large extent by hypnosis and to a smaller extent by distraction.

Hypnosis compared to standard or usual care. Six of the studies included a simultaneous usual or standard medical treatment (SMT) as one of the control conditions (Kuttner et al., 1988; Liossi & Hatira, 1999, 2003; Liossi et al., 2006, 2009; Vlieger et al., 2007). Hypnosis proved to be significantly better than SMT (i.e., standard intervention given by health professionals for pain control) at reducing pain and distress in studies on functional abdominal pain and irritable bowel syndrome (Vlieger et al., 2007) and cancer procedure-related pain (Kuttner et al., 1988; Liossi & Hatira, 1999, 2003; Liossi et al., 2006, 2009).

Kuttner et al. (1988) randomized 48 children suffering from cancer and undergoing BMA and lumbar punctures (LP) to one of three different groups: hypnosis, distraction, or SMT. They reported that at the first intervention hypnosis appeared to be the only treatment that was able to reduce distress significantly for the younger children (3 to 6 years old), whereas the older children (7 to 10 years old) achieved significant reductions in both experimental conditions for observed pain and anxiety. Self-rated pain and anxiety proved that there were no significant differences across groups. At the second intervention, all groups presented reductions in distress, pain, and anxiety. Liossi and Hatira (1999) compared hypnosis, cognitive behavioral coping skills, and standard medical treatment (SMT) groups in children suffering from cancer. They found that hypnosis was more successful than cognitive behavioral coping skills at reducing anxiety and observed distress, but both treatments appeared to be equally effective at reducing pain. Reduction in pain, anxiety, and observed distress was related to the level of hypnotizability in the hypnosis and cognitive behavioral coping-skills groups. In another study, Liossi et al. (2006) found that a group of children with cancer pain receiving a combination of SMT—consisting of EMLA (eutectic mixture of local anesthesia)—and hypnosis had less anticipatory anxiety and less procedure-related pain and anxiety than those children receiving EMLA or EMLA plus a so-called attention control intervention. Children in the hypnosis group presented less behavioral distress (i.e., intensity of the reaction to pain or anxiety; specifically, verbalized pain and anxiety, screams, and physical resistance) during the procedure; the level of hypnotizability was significantly associated with the size of treatment benefit. Across self-reported and observed indices of distress, benefit was maintained at 6-month follow-up when patients used self-hypnosis. The effect sizes and percentage of change in pain intensity were as follows: between baseline and hypnosis: SMT: 2.26 and 38%; SMT plus hypnosis: 4.5 and 72%; between baseline and Self-hypnosis 2: SMT, 2.87 and 48.5%; SMT plus hypnosis, 4.96 and 80%; and between baseline and Self-hypnosis 3: SMT, 2.97 and 50%; SMT plus hypnosis, 4.77 and 77%.

In a more recent study on 45 children with cancer undergoing a venipuncture using the same experimental and control conditions as in

their 2006 study, Liossi et al. (2009) found that children in the EMLA-plus-hypnosis group reported less anticipatory anxiety, procedure-related pain, anxiety, and behavioral distress than children in the other groups. Parents whose children were in the experimental group reported less anxiety during their child's procedure than the control groups. The therapeutic effect of a brief hypnosis intervention was maintained in the follow-up.

Finally, Vlieger et al. (2007) examined the use of hypnosis in the management of functional abdominal pain and irritable bowel syndrome-related pain in 53 children. Children received either hypnosis or SMT interventions and were compared for abdominal and headache pain, as well as for associated symptoms (e.g., nausea, vomiting, and loss of appetite), which were assessed on a daily basis. The SMT group received dietary advice, education, extra fiber, and pain medication/proton-pump inhibitors if necessary. They found that pain intensity decreased significantly during and after treatment in both groups (hypnosis and SMT). However, the decrease in the hypnosis group was much greater, and there was a significantly greater reduction in pain scores (pain intensity and frequency). The associated symptoms decreased significantly between baseline and 1 year of follow-up for both groups. At the end of the treatment, 59% of the patients in the hypnosis group showed clinical remission of pain (i.e., decrease in the pain intensity and frequency scores of >80%) versus 12% in the SMT group; at 1-year follow-up, treatment was successful in 85% of the hypnosis group and 25% of the SMT group. There were also age differences in the response to treatment: children under 14 years old responded significantly better than adolescents during treatment up until 6 months after both interventions.

Hypnosis added to another treatment. This type of control condition consists of a nonhypnotic treatment, in itself thought to benefit pediatric pain patients, which is added to hypnosis. We identified three studies that used hypnosis combined with medical interventions as a control condition for managing cancer procedure-related pain (Liossi & Hatira, 2003; Liossi et al., 2006, 2009). In summary, patients receiving hypnosis added to the usual treatment protocol reported significantly greater pain reductions, as well as reduced anxiety and distress than those who received the same treatment without hypnosis.

Hypnosis compared to other treatments. Seven of the trials compared hypnosis with such other treatments as cognitive-behavioral coping skills (Liossi & Hatira, 1999), distraction (Kuttner et al., 1988; Smith et al., 1996; Wall & Womack, 1989; Zeltzer & LeBaron, 1982), play (Katz et al., 1987), and medication (i.e., propranolol; Olness et al., 1987). Briefly, these articles provide evidence that hypnosis was effective at reducing pain, anxiety, and distress. In comparison to cognitive-behavioral coping skills, in which imagery was not included (Liossi &

Hatira, 1999), hypnosis proved to be better at reducing anxiety and distress but no differences were reported for pain. The results of comparing hypnosis with distraction are inconclusive: that is, hypnosis proved to be equally effective at reducing pain in two studies (Kuttner et al., 1988; Wall & Womack, 1989), but superior in two others (Smith et al., 1996; Zeltzer & LeBaron, 1982). Play and hypnosis had the same effects on fear and pain reduction (Katz et al., 1987). Finally, hypnosis proved to be better than medication at reducing the frequency of headache pain episodes (Olness et al., 1987).

Smith et al. (1996) identified 27 children severely ill with cancer and blood disorders and enrolled them in hypnosis or distraction intervention groups for the management of pain and anxiety. The hypnotizability of all the children was measured with the Stanford Hypnotic Clinical Scale for Children (Morgan & Hilgard, 1978), a questionnaire that includes six tasks on hypnotic ability after an eyes-open imaginative-involvement induction. They were then assigned to one of two sequences of intervention: hypnosis and distraction or distraction and hypnosis. Thus, 7 highly hypnotizable children and 7 less hypnotizable children used hypnosis first, and 6 highly hypnotizable children and 7 less hypnotizable children used distraction first. The authors reported that hypnosis was significantly more effective than distraction at reducing pain, anxiety, observed anxiety, perceptions of behavioral distress, parent-reported pain, and anxiety in highly hypnotizable children. In the hypnosis treatment, only the hypnotizable group reported significantly less self-reported pain and anxiety. On the other hand, the distraction intervention produced significantly less observed anxiety for the less hypnotizable children. The effect sizes and reduction in pain intensity from baseline to posttreatment were the following: (a) hypnosis group: highly hypnotizable, 1.37 and 59%; less hypnotizable, 0.12 and 4%; (b) distraction group: highly hypnotizable, 0.90 and 4%; less hypnotizable, 0.80 and 23%. Another study conducted by Wall and Womack (1989) investigated children suffering from cancer and found that both hypnosis and distraction interventions were effective at reducing pain, but neither reduced anxiety. Still, the investigators reported that observed behavioral anxiety decreased (investigators rated children's anxiety during an invasive medical procedure using a 10 cm visual analogue scale). No significant differences were found between the groups, and hypnotizability failed to correlate with the degree of pain or anxiety reduction. Finally, Katz et al. (1987) also analyzed children with cancer and reported that both hypnosis and playgroups were equally effective at decreasing fear and pain between baseline and subsequent bone marrow aspirations but had no significant effect on observed distress. Response to hypnosis and rapport rating correlated positively and significantly during the initial training sessions but not during the actual procedures. Effect sizes and pain-intensity reduction were the following: (a) between baseline and

Posttreatment 1: hypnosis, 0.86 and 27%; and play, 1.05 and 36%; (b) between baseline and Posttreatment 2: hypnosis, 0.78 and 25%; play, 0.67 and 23%; (c) between baseline and Posttreatment 3: hypnosis, 0.62 and 20%; play, 0.85 and 29%.

Hypnosis compared to placebo control. Only one of the published studies compared hypnosis to an equally credible placebo pain treatment for migraine (Olness et al., 1987). The authors of this clinical trial randomized children into a drug treatment (propranolol at 3mg/kg/d) or placebo group for a 3-month period and then crossed over for 3 months. After this 6-month period, all the children learned self-hypnosis and used it for 3 months. Findings revealed that the mean number of headaches per child for 3 months during the placebo period was 13.3 compared with 14.9 during the propranolol period and 5.8 during the self-hypnosis period. There was a significant decrease in headache frequency after self-hypnosis training, suggesting that hypnosis has more than a placebo effect on relieving chronic pain.

Hypnosis compared to attention control. Three studies compared hypnosis to an attention control group (Liossi & Hatira, 2003; Liossi et al., 2006, 2009). In all three, the control condition consisted of rapport development, nonmedical play, and nonmedical verbal interactions. Generally speaking, the results of these studies demonstrated the superiority of hypnosis in the management of pediatric cancer pain. Patients in the hypnosis groups reported less pain and anxiety and less observed behavioral distress than those in the control groups.

Summary of main findings. To summarize, the studies included in this review revealed that hypnotic interventions were better at reducing pain than no treatment (P. J. Hawkins et al., 1998; Liossi & Hatira, 2003; Olness et al., 1987; Zeltzer & LeBaron, 1982), medical standard care (Kuttner et al., 1988; Liossi & Hatira, 1999, 2003; Liossi et al., 2006, 2009; Vlieger et al., 2007), placebo (Olness et al., 1987), and attention control conditions (Liossi & Hatira, 2003; Liossi et al., 2006, 2009). When hypnosis is compared to other psychological treatments results are somewhat mixed. For example, hypnosis was just as effective at reducing pain intensity as a Cognitive Behavioral Therapy protocol (Liossi & Hatira, 1999), play (Katz et al., 1987), and distraction (Kuttner et al., 1988; Wall & Womack, 1989) but was better than distraction in other studies (Smith et al., 1996; Zeltzer & LeBaron, 1982). Finally, pain reduction was greater in treatments with hypnosis as an adjunct than in those without (Liossi & Hatira, 2003; Liossi et al., 2006, 2009, respectively). There were also some age differences in hypnotic responsiveness: Younger patients reported a significantly better response to treatment than older ones (Kuttner et al., 1988; Vlieger et al., 2007).

Nevertheless, the studies reviewed showed certain limitations that must be acknowledged. First, the samples were small so there was little power to detect group differences. Second, follow-ups were few and shorter than necessary so the long-term effects of hypnosis are not well known yet. Third, process variables that might help to explain the effects of hypnosis are missing in most studies, making it impossible to analyze the underlying mechanisms.

What Evidence Is There To Suggest That Hypnotizability Can Affect Positive Outcomes?

It has been suggested that hypnotizability—that is, a patient's ability to experience and respond to hypnosis in general—is associated with improvements in pain after hypnotic treatment (Montgomery et al., 2000). In this review, six studies on procedure-related pain in children with cancer assessed hypnotizability. They all used the Stanford Hypnotic Clinical Scale for Children (Morgan & Hilgard, 1978). Four of them assessed hypnotizability before the intervention took place (Liossi & Hatira, 1999; Liossi et al., 2006; Smith et al., 1996; Wall & Womack, 1989), and the other two assessed hypnotizability afterward (P. J. Hawkins et al., 1998; Liossi & Hatira, 2003). All but one (Wall & Womack, 1989) reported a positive association between hypnotizability and improvements in pain after hypnotic treatment, and patients with the highest level of hypnotizability got the most benefit both immediately after the treatment and at follow-up (Liossi et al., 2006; Smith et al., 1996).

What Are the Characteristics of the Successful Hypnotic Protocols That Have Been Published on the Management of Pediatric Pain?

Content of treatment. All studies described their hypnotic treatments, although some in greater detail than others, and can be considered to be homogeneous in their content. Table 2 provides a description of the hypnotic interventions used in each of the studies reviewed. They focused on imaginative involvement and used similar hypnotic induction procedures (i.e., relaxation or ideomotor techniques, such as arm levitation or eye fixation), hypnotic suggestions for pain control (e.g., anesthesia, analgesia), followed by posthypnotic suggestions for comfort, well-being, and self-mastery, as well as ego-strengthening suggestions. Two studies (P. J. Hawkins et al., 1998; Liossi & Hatira, 2003) compared the effectiveness of direct and indirect hypnotic suggestions.[3]

[3]Direct suggestions deal with the problem at hand or the specific response desired overtly and clearly, providing specific directions on how to respond. Indirect suggestions, however, relate to the problem in a covert and unobtrusive way. They can be quite subtle and not directly related to the person's conscious experience (Yapko, 2003).

No differences were observed: The benefits in pain reduction for the participants in both groups were similar.

Amount of treatment. No studies have analyzed whether the number and duration of treatment sessions had any influence on results. The number of sessions varied greatly among the chronic pain studies in the review; they went from 6 sessions (Olness et al., 1987) to 12 sessions (Vlieger et al., 2007). The duration of the sessions was largely homogenous among the studies, lasting between 50 and 60 minutes. The studies on cancer procedure-related pain included one or two sessions ranging from 15 to 40 minutes (see Table 2).

Administration of treatment. The experienced hypnotherapists (professionals with clinical experience in the use of hypnosis in the context of pediatric pain) always trained participants, but there were some differences in how the treatments were implemented. For example, manualized protocols were used in four of the studies reviewed (Liossi & Hatira, 2003; Liossi et al., 2006, 2009; Vlieger et al., 2007) and self-hypnosis training in three (Smith et al., 1996; Vlieger et al., 2007; Wall & Womack, 1989). None of the studies attempted to analyze whether the way in which hypnosis was administered made any difference to the results. Hypnotic sessions were conducted individually (individual sessions were tailored to the child's preferences, dislikes, fears, and hopes).

Discussion

The purpose of this review was to perform a systematic search for randomized controlled studies that have been undertaken for the specific purpose of assessing the effects of hypnosis on the management of chronic and cancer procedure-related pain problems in pediatric patients. We were able to identify 12 such studies. Overall, the results of these studies showed that hypnosis—by itself or in combination with other techniques—is effective at helping young people manage their pain. In particular, the results of these studies showed that hypnotic interventions are significantly more effective at reducing pain than no treatment (P. J. Hawkins et al., 1998; Liossi & Hatira, 2003; Olness et al., 1987; Zeltzer & LeBaron, 1982), placebo (Olness et al., 1987), or attention control conditions (Liossi & Hatira, 2003; Liossi et al., 2006, 2009). Hypnosis was also better than medication (Olness et al., 1987) and standard medical care (Kuttner et al., 1988; Liossi & Hatira, 1999, 2003; Liossi et al., 2006, 2009; Vlieger et al., 2007). Results were less consistent, however, when hypnosis was compared to other psychological-type treatments such as play (Katz et al., 1987), distraction (Kuttner et al., 1988; Smith et al., 1996; Wall & Womack, 1989; Zeltzer & LeBaron, 1982), or cognitive-behavioral coping-skills

intervention (Liossi & Hatira, 1999). Although few studies have evaluated the effects of hypnosis as an adjunct to other treatments for chronic pain, the findings available show that treatments with hypnosis lead to greater pain reductions than those without (Liossi & Hatira, 2003; Liossi et al., 2006, 2009).

The studies that allowed the effect sizes to be calculated revealed a significant decrease of between 20% and 80% in pain intensity for those children who participated in the hypnosis groups. The magnitude of pain reduction varied across studies. Follow-up designs were only mentioned by a few studies, but they indicated that the therapeutic effects of hypnosis were lasting and stable after treatment had been completed and could be observed at 3 months (e.g., Liossi et al., 2009), 6 months (e.g., Liossi et al., 2006; Vlieger et al., 2007), and even 12 months (e.g., Vlieger et al., 2007).

Several well-designed studies, then, have demonstrated that hypnotic treatment is effective. However, we have yet to understand the underlying mechanisms that are responsible for its positive effects. For clinicians and/or patients, this might not be a crucial issue, as Jensen and Patterson (2006) pointed out, but it is critical for researchers, and it needs to be addressed by future studies. Similarly, future studies need to identify when, for what, and for whom hypnotic treatment is appropriate and whether it should be administered alone or in combination with other techniques. Age and gender effects have been observed. For example, some studies indicate that girls (Katz et al., 1987), younger children (Kuttner et al., 1988), and children with initial high levels of pain (Wall & Womack, 1989) may benefit the most from hypnotic treatment. However, further research is needed because some of the findings are contradictory (e.g., Vlieger et al., 2007; Zeltzer & LeBaron, 1982).

Some of the papers in this review studied the potential value of hypnotizability as a predictor of hypnosis effects. Hypnotizability was found to predict treatment outcomes in all studies that specifically addressed this question (P. J. Hawkins et al., 1998; Liossi & Hatira, 1999, 2003; Liossi et al., 2006; Smith et al., 1996) except one (Wall & Womack, 1989). These results converge with the findings of the meta-analysis on adult hypnosis conducted by Montgomery and colleagues (2000), which concluded that hypnoanalgesic effects differ according to levels of hypnotic suggestibility; that is to say, individuals with higher levels of suggestibility experience greater pain relief. Further studies are needed to clearly determine whether hypnotizability is a good predictor of outcomes.

Recommendations for Future Research

Future studies need to examine the effects of hypnotizability while controlling for the effects of the time over which it is assessed. It would

also be worthwhile investigating whether it can be taught and therefore improved (i.e., as a modifiable skill; Gorassini & Spanos, 1986) or whether it is stable throughout life (E. R. Hilgard & Hilgard, 1995).

Differences in the procedures mean that they cannot be easily compared or the components essential to the strategies identified; for example, several studies included self-hypnosis and instructions for practicing it at home (e.g., Katz et al., 1987; Liossi & Hatira, 2003; Liossi et al., 2006, 2009; Olness et al., 1987) but not all of them. This lack of standardization of hypnotic protocols needs to be addressed by future studies, and some basic standardization is needed if knowledge is to advance. For example, how many sessions are needed? Should we replicate protocols that are used with adults? Or, if children are really more hypnotizable than adults, will the same results be achieved in fewer sessions (Liossi & Hatira, 2003; Vlieger et al., 2007)? How long should sessions be? What is regarded as hypnosis and what it is not? A common operational definition of "hypnotic analgesia" would increase the chances of developing a literature base that would allow for comparisons between different studies (Elkins, Jensen, & Patterson, 2007; Jensen & Patterson, 2006). Standardized hypnotic protocols may also be seen as a limitation for clinical research since individual differences in mental imagery, absorption, preferences, age, developmental stage, and learning styles might be deleted from the picture. However, standardized protocols have both theoretical and clinical advantages. For example, they would facilitate objective comparisons between studies, and hypnotherapists could replicate and use protocols proved to be efficient—and they would certainly be tailored to the needs of the patient (see Jensen & Patterson, 2006, for their standard hypnosis treatment proposal). When identifying controlled trials for this review, we found that the line between hypnosis and other interventions (e.g., relaxation and imagery) is blurred and can lead to confusion (e.g., Holden, Deichmann, & Levy, 1999). On the basis of the studies reviewed, we suggest that hypnosis could be integrated into daily clinical practice. First, it has proved to be instrumental in reducing children's pain, anxiety, and distress. Second, it does not require a great investment of time and/or external resources. Third, it does not produce adverse effects or drug interaction, it is a flexible technique that is easy to use in the medical context, and it can suit a wide range of patients and their families (Smith et al., 1996).

Although further research is needed, the body of data we have gathered indicates that hypnosis is a suitable pain control technique for young people with chronic or cancer procedure-related pain. There is less research on chronic pain, but the findings available do appear to be promising. More research is required to fully determine the effects of hypnosis on the wide range of chronic pain conditions: that is to say, which hypnotic technique is most appropriate for each particular

circumstance. High-quality research is required that uses randomized controlled trials, repeated-measures designs, suitable sample sizes, and appropriate control groups. Future work should include follow-ups, drop-out analysis, and multiple baseline measures. Studies should also be made of the amount of practice at home and the number of sessions required if hypnotic treatment is to work effectively. Future researchers could well build on these encouraging findings by formalizing the description of the procedures implemented and examining the treatment and patient variables that are theoretically related to the principal outcomes.

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Hypnose zur Behandlung von chronischem und Krebsbehandlungs-bezogenem Schmerz bei Kindern

Catarina Tomé-Pires und Jordi Miró

Abstrakt: Das Ziel dieser Studie war die Aufarbeitung bereits publizierter kontrollierter Untersuchungen zu hypnotischen Behandlungen von chronischem und Krebsbehandlungs-bezogenem Schmerz bei Kindern. Untersuchungen wurden miteinbezogen, wenn Teilnehmer 18 Jahre alt oder jünger waren, wenn sie randomisiert waren und Gruppen mit chronischem Schmerz oder Krebsbehandlungs-bezogenem Schmerz beinhalteten. Nachdem die Studien eingeschätzt worden waren, wurden 12 für eine Revision ausgewählt. Obwohl die Beweise begrenzt sind, zeigen sie, daß Hypnose eine effiziente Technik zur Schmerzkontrolle ist, wenn sie bei

Kindern, die an krebsbehandlungsbedingtem oder chronischem Schmerz leiden, angewandt wird. Weitere Forschung auf dem Gebiet des Einsatzes der Hypnose, um chronischen Schmerz bei Kindern zu behandeln, sollte vorrangig sein, sodaß empirisch basierte Folgerungen über die Effekte von Hypnose auf Kinder gezogen werden können.

STEPHANIE REIGEL, MD

L'hypnose dans la gestion de la douleur chronique ou de la douleur liée aux interventions en oncologie chez les enfants

Catarina Tomé-Pires et Jordi Miró

Résumé: cette étude visait à examiner les données publiées d'essais comparatifs portant sur des traitements hypnotiques dans les cas de douleur chronique ou de douleur liée aux interventions en oncologie chez des enfants. Seuls les essais comprenant des participants âgés de 18 ans ou moins, sélectionnés au hasard et souffrant de douleur chronique ou de douleur liée aux interventions en oncologie, ont été inclus dans cette étude. Après évaluation des essais, 12 ont été sélectionnés pour examen. Bien que les preuves soient limitées, cet examen indique que l'hypnose constitue une technique efficace de maîtrise de la douleur chez des enfants souffrant de douleur chronique ou de douleur liée aux interventions en oncologie. D'autres recherches sur l'emploi de l'hypnose pour gérer la douleur chronique chez les enfants devraient représenter une priorité, afin que l'on puisse tirer des conclusions empiriques sur les effets de l'hypnose sur les enfants.

JOHANNE REYNAULT
C. Tr. (STIBC)

La hipnosis para el manejo de dolor crónico y el relacionado con procedimientos oncológicos en niños

Catarina Tomé-Pires y Jordi Miró

Resumen: El propósito de este estudio fue la revisión de ensayos clínicos de tratamientos hipnóticos para el dolor crónico y el relacionado con procedimientos oncológicos en niños. Los ensayos se incluyeron si los participantes tenían 18 años o menos, estuvieron aleatorizados, y tenían poblaciones con dolor crónico o dolor relacionado con procedimientos oncológicos. Después de evaluados los estudios, se seleccionaron 12 para revisión. Aunque la evidencia es limitada, los resultados indican que la hipnosis es una técnica para el control de dolor efectiva cuando se usa con niños que sufren de dolor relacionado con procedimientos oncológicos o dolor crónico. Más investigación sobre el uso de la hipnosis para el manejo de dolor crónico en niños debería ser una prioridad para se puedan derivar conclusiones sustentadas empíricamente sobre los efectos de la hipnosis en niños.

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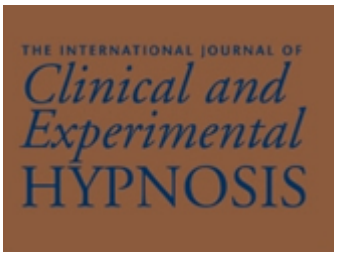
3. Study III: Use of hypnotic techniques in children and adolescents with chronic pain: do age of patients, and years of practice with hypnosis and theoretical orientation of clinicians matter?



Use of hypnotic techniques in children and adolescents with chronic pain: do the ages of patients or years of practice and theoretical orientation of clinicians matter?

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ABSTRACT

Background: Although hypnosis has proven efficacious in the treatment of chronic pain in adults and children, the treatment encompasses a large variety of techniques, some of which may be more effective than others. In order to better understand which strategies might be most useful, more knowledge is needed regarding the specific strategies that are actually used by experienced clinicians, and the factors that influence their use. This study investigated the role of three variables on the endorsement and delivery of hypnotic techniques in youth with chronic pain: (1) the age of the patients, (2) the theoretical orientation of the clinician, and (3) the number of years of hypnosis practice of the clinician. **Methods:** Thirty-five health care professionals completed an online survey on the use of clinical hypnosis in the management of pediatric chronic pain. A number of non-parametric tests were performed to examine the predictors of the use of hypnotic induction techniques and suggestions. **Results:** For the most part, the use of specific hypnotic techniques was not significantly associated with professionals' theoretical orientation or years of clinical experience. However, the use of hypnotic techniques was found to be significantly associated with patient age. **Conclusions:** The findings indicate that clinicians vary their use of hypnotic strategies primarily as a function

of patient age, rather than as a function of either their theoretical orientation or amount of clinical experience. The findings may be useful for guiding clinicians in their selection of induction strategies and suggestions when working with children with chronic pain.

Keywords: hypnosis, survey, pediatric chronic pain

INTRODUCTION

A large and growing number of studies demonstrate that hypnosis is effective in the management of pain in adults and youths with acute, chronic, or cancer procedure-related pain problems (e.g., Montgomery et al., 2000; Jensen & Patterson, 2006; Stoelb et al., 2009; Tomé-Pires and Miró, 2012). Although the effectiveness of "hypnosis" is now well established, there remain significant differences in how hypnotic techniques are applied. For example, there are tens if not hundreds of different hypnotic induction procedures (e.g. relaxation, eye fixation) that are commonly used by clinicians. Similarly, there are numerous different types of suggestions (e.g. direct, symptom-oriented) that can be offered to patients.

A number of factors could potentially influence a clinician's decision to choose the use of a specific type of induction or suggestion over another one. One such factor is the health professional's hypnosis theoretical orientation (e.g., viewing hypnosis as an altered state vs. a social cognitive phenomenon). As noted by Christensen (2005), there are many ways to describe the phenomena and experience of hypnosis. Primary theoretical conceptualization of hypnosis as an "identifiable state" (i.e., altered state of consciousness, trance-like; e.g. Bowers, 1966; Orne, 1959) and as a "social-cognitive phenomenon" (i.e., influenced by the same factors that influence all other behaviors; e.g. Barber, 1969; Sarbin, 1950; Kirsch, 1991) has been previously studied among professionals using hypnosis. Available reports have shown that the conceptualization of hypnosis as an altered state of consciousness is preferred (Kirsch, 1993; Christensen, 2005). Thus, professionals who believe that hypnosis represents a special

state or condition may use hypnotic induction techniques in order to deepen such a state in order to achieve better outcomes. On the other hand, socio-cognitive clinicians may not place as much an emphasis on induction techniques, as hypnotic response is considered to be a product of social influence and personal abilities of the hypnotized person (Lynn & Rhue, 1991; Spanos, 1986).

Another possible factor that could impact the selection and use of different inductions and suggestions is clinical experience. Presumably, as clinicians become more experienced, they would tend to use a greater number of strategies that are most effective, and use fewer approaches that do not work as well. That is, their clinical behavior might be shaped over time, with a positive patient response being a primary reinforcer. If so, then those strategies used more often by the more experienced clinicians *might* have a greater chance of being most effective, on average.

Finally, it is possible that the age of the patient could influence the specific inductions and hypnotic suggestions chosen by clinicians. Experts argue that hypnotherapeutic inductions and suggestions should fit children`s developmental stage as well as social-emotional needs (Ollness and Kohen, 1996). Thus, successful work with children requires that the professional adapts induction procedures and suggestions to the child's age (Kohen in Hammond, 1990; Olness and Gardner, 1988).

Given the above considerations, the primary aim of the present work was to examine the frequency of use of specific hypnotic inductions and suggestions, and the associations of these with the clinicians' theoretical orientation, years of clinical experience, and age of the patient. We anticipated that the findings would be useful for clinicians to identify hypnotic strategies they might use in their work with youth with chronic pain, as well as for generating hypotheses that could be tested in order to identify the most useful and effective approaches in pediatric hypnosis practice.

METHODS

Participants

Participants (N= 35) were health professionals who were invited to take part in an online survey. Inclusion eligibility criteria were being a professional using hypnosis in their clinical practice in the context of pediatric chronic pain with involvement (1) in clinical research on this topic (at least being the first author of 1 paper or the co-author of 2 papers on the use of hypnosis in pediatric chronic pain) or (2) in clinical work (at least 2 years of experience working in the context of pediatric chronic pain).

Collecting the information: the Survey

In order to gather information on the use of clinical hypnosis in youths (≤ 18 years old) with chronic pain, we developed a survey (in English) in collaboration with clinicians and researchers from The Milton H. Erickson Institute of Rottweil (Germany). After an initial draft of the survey was created, its questions were shown to 8 expert clinical psychologists and paediatricians using hypnosis. These experts assessed the initial draft of the survey and were asked to indicate if any critical questions were not included or should be modified, based on their experience with hypnosis with youths with chronic pain.

The final version of the survey included 89 questions and was divided in three sections: (1) demographic information about the clinician (e.g., occupation, nationality, age, sex); (2) clinical experience information about the clinician (e.g., years of practice); and (3) information about the use of hypnosis with children and adolescents with chronic pain. To address the research questions of this work, we asked about the use of 11 specific hypnotic induction strategies (relaxation, favorite place/game, storytelling, absorption in breathing, games/toys, metaphors, focus on sensations, eye fixation, sensorimotor, counting methods, and pop-up story books) and nine specific types of hypnotic suggestions (visualization, storytelling, sensorimotor, supportive ego-enhancement, dynamic/insight oriented, symptom-oriented, direct, indirect, permissive).

Procedure

Potential participants were contacted directly via email or by asking Hypnosis Associations, Societies and Institutes to identify possible respondents. In addition, we contacted a number of clinicians and researchers (i.e., health professionals) who have published in the topic area. We contacted a total of 68 international associations/societies/institutes, and 115 health care professionals. Individuals who expressed an interest in participating were sent a web link which they could use to access an electronic version of the survey. That link provided them with a brief introduction describing the study purposes and that listed the study participation inclusion criteria, followed by a request for voluntary participation. *Kwik surveys* and *Free online surveys* were both used to launch the study survey and collect data. Health care professionals who met the inclusion criteria and were willing to participate completed the online questionnaire. Participant anonymity and confidentiality were maintained by assigning a numerical code to each of the completed questionnaires. The survey took 20-30 minutes to complete on average, and was available online from April 2012 to December 2012. Although the clinicians were not paid for participation, they did participate in a random drawing for a kindle wireless reading device.

Data analyses

We first computed descriptive statistics (percentages, means, and standard deviations, as appropriate) to describe the sample and use of each induction and suggestion strategies were computed. Next we performed a series of non-parametric analyses (chi-square or Cochran's Q test, as appropriate) to examine the associations between years of experience with hypnosis (using a median split comparing those reporting ≤ 7 years hypnosis experience with those reporting > 7 years hypnosis experience), theoretical orientation (altered state *vs*. social cognitive orientation), and patient age (3-6 years (pre-scholars) *vs*. 7-11 years (first graders) *vs*. 12-18 years (second graders) on reported use of different hypnotic induction

strategies and suggestions. All data were analyzed by using the SPSS 17.0 version (IBM, I believe you should insert city and country of IBM here, or alternatively the website).

RESULTS

Description of the survey respondents

Table 1 presents descriptive information about the 35 survey respondents. As can be seen, about half were men and half women ($\bar{X}$= 50 years old; SD= 11.46). Survey respondents included psychologists (16) and physicians (15) of various specialties (i.e. pediatricians, pediatric pulmonologist, psychiatrists, physicians), and nurses (4). They were mainly from United States (17), but also included individuals from France (5), Germany (4), Portugal (2), Spain, Belgium, Israel, Canada, the Netherlands, United Kingdom, and Morocco (1 each). There was considerable variability in the number of years of clinical practice (3 to 47 years), pain management clinical practice (2 to 43 years), and hypnosis clinical practice (2 to 38 years). The majority reported that they had specialist training in all four areas asked (chronic pain, pediatric pain, hypnosis, and pediatric hypnosis), although a number of professionals reported that they did not have specialized training in pediatric pain management (25%) or pediatric hypnosis (20%).

Table 1. Description of the characteristics of our clinicians sample

Variable	Number (%), or Mean (SD, range)
Sex	
Men	16 (46%)
Women	19 (54%)
Age	50.35 (11.46, 31-70)
Years of practice	22.63 (12.76, 3-47)
Years of practice in pain management	14.71 (13.23, 2-43)
Years of practice in hypnosis	11.11 (9.78, 2-38)
Specialist training in pain	30 (86%)
Specialist training in pediatric pain	26 (75%)
Specialist training in hypnosis	34 (97%)
Specialist training in pediatric hypnosis	28 (80%)
Participant's specialties	
Psychology	16
Medicine	15
Nursing	4
Participant's country of residence	
USA	17
France	5
Germany	4
Portugal	2
Belgium	1
Canada	1
Israel	1
Morocco	1
Netherlands	1
Spain	1
United Kingdom	1

Survey respondents were psychologists (16), medical doctors (15) of various specialties (i.e. paediatricians, pediatric pulmonologist, psychiatrists, physicians), and nurses (4). They were mainly from United States (17), followed by France (5), Germany (4), Portugal (2), Spain, Belgium, Israel, Canada, the Netherlands, United Kingdom, and Morocco.

Clinical use of hypnosis as a function of clinician number of year of experience with hypnosis

A median split was used to classify the study participants into those with more (> 7 years, n = 19) or less (≤ 7 years, n = 16) clinical experience with hypnosis. Although we found a 20% or greater between-group difference in the use of some inductions (e.g., use of games/toys, eye fixation, and sensorimotor inductions were used more by those with less experience), none of the differences between those with more or less experience were statistically significant. When examining differences in the use of inductions and suggestions as a function of years of experience for each of the three patient`s age groups (20 inductions or suggestions X 3 age cohorts = 60 statistical comparisons), only one (i.e., 2%) statistically significant effect emerged; the more experienced clinicians used absorption in breathing as an induction in the 12-18 year old age group than the less experienced clinicians (100% *vs*. 67%, χ^2 (1) = 6.11; p< .05).

Table 2. Types of hypnotic inductions and suggestions (percentage use) as a function of experience years with hypnosis

	Experience years with hypnosis	
	≤ 7years (%)	> 7years (%)
Induction strategies		
Relaxation	100	89
Favorite place/game	94	94
Storytelling	67	89
Absorption in breathing	100	78
Games/toys	80	56
Metaphors	87	78
Focus on sensations	53	78
Eye fixation	73	44
Senorimotor	73	44
Counting methods	33	50
Pop-up books	36	12
Suggestions		
Visualization	100	94
Storytelling	94	100
Sensorimotor	88	78
Supportive ego-enhancement	88	72
Dynamic/insight-oriented	38	39
Symptom-oriented	56	67
Direct	63	71
Indirect	81	88
Permissive	63	56

Pop-up books were only reported to be used on the younger age group (i.e. 3-6 years old)

Clinical use of hypnosis as a function of clinician theoretical orientation

Twenty-one (60%) of the survey respondents endorsed a view of hypnosis as an altered state of consciousness, and 11 (31%) viewed it as a social cognitive phenomenon (i.e., not an altered state of consciousness). The remaining three participants (9%) did not endorse either of these views, and defined hypnosis as either (1) a mixture of both an altered state of consciousness and a cognitive-social phenomenon, (2) a cognitive-behavioral method and (3) a natural state. Although there were some differences in endorsement of use of specific inductions and suggestions as a function of theoretical orientation, with a 20% or greater difference in the use of sensorimotor inductions (social-cognitive clinicians used this more than the altered state clinicians), use of direct suggestions (social-cognitive > altered state) and use

of permissive suggestions (altered state > social cognitive), none of these differences reached statistical significance. In 60 analyses to examine differences in the use of inductions and suggestions between the different age groups and as a function of theoretical orientation, only one (2% of the analyses) significant effect emerged; the use of metaphors as an induction was used less by clinicians who viewed hypnosis as an altered state of hypnosis than by those who viewed it as a cognitive-social phenomenon in children who are in the 7-11 years old age group (40% *vs*. 82%, $\chi^2(1) = 5.01$; $p < .05$).

Table 3. Types of hypnotic inductions and suggestions (percentage of use) as a function of years of self-reported theoretical orientation

	Theoretical orientation	
	Altered state (%)	Social-cognitive (%)
Induction strategies		
Relaxation	95	91
Favorite place/game	95	91
Storytelling	71	91
Absorption in breathing	91	82
Games/toys	71	55
Metaphors	76	91
Focus on sensations	76	55
Eye fixation	57	73
Sensorimotor	48	73
Counting methods	43	46
Pop-up books	21	27
Suggestions		
Visualization	100	91
Storytelling	95	100
Sensorimotor	86	73
Supportive ego-enhancement	86	64
Dynamic/insight-oriented	33	45
Symptom-oriented	62	64
Direct	57	90
Indirect	81	90
Permissive	95	70

Pop-up books were only reported to be used on the younger age group (i.e. 3-6 years old).

Clinical use of hypnosis as a function of the patients` age

Analyses to examine the effects of patients' age on the use of specific inductions and suggestions yielded statistically significant effects for 17 out of the 20 strategies (see Table 4). As can be seen, relaxation, absorption in breathing, metaphors, focusing on sensations, eye fixation, sensorimotor approaches, and counting methods are used significantly less often as inductions with very young children (3-6 years old), relative to older ones. On the other hand, use of favorite place/games, storytelling, and use of games and toys are used significantly less often in adolescents (12-18 years old) than in younger children. Pop-up books were never used in children over 6 years old. With respect to hypnotic suggestions, we found that visualization, supportive ego-enhancement, dynamic/insight oriented, symptom-oriented, indirect, and permission strategies are used less often for younger children, while storytelling and direct suggestions are used less often in older children. Still, all of the inductions and suggestions are used by at least by some clinicians for all age groups, with the exception of dynamic/insight-oriented suggestions, which were reported to never have been used for the youngest patients (3-6 year old).

Table 4. Types of hypnotic inductions and suggestions (percentage use) as a function of age group

	Patient age group			Cochran's
	3-6 years	7-11 years	12-18 years	Q
Induction strategies				
Relaxation	37%$_a$	80%$_b$	83%$_b$	23.06***
Favorite place/game	74%$_a$	80%$_a$	57%$_b$	9.50**
Storytelling	66%$_a$	51%$_a$	34%$_b$	5.38
Absorption in breathing	23%$_a$	66%$_b$	77%$_b$	26.80***
Games/toys	54%$_a$	26%$_a$	3%$_b$	25.68***
Metaphors	29%$_a$	49%$_b$	74%$_b$	16.44***
Focus on sensations	34%$_a$	43%$_b$	57%$_b$	5.60
Eye fixation	6%$_a$	37%$_b$	57%$_b$	21.78***
Sensorimotor	3%$_a$	31%$_b$	46%$_b$	21.88***
Counting methods	6%$_a$	20%$_b$	31%$_b$	12.20**
Pop-up books	20%$_a$	0%$_b$	0%$_b$	14.00**
Suggestions				
Visualization	46%$_a$	83%$_b$	91%$_b$	22.88***
Storytelling	83%$_a$	69%$_b$	51%$_b$	13.63**
Sensorimotor	51%	63%	63%	2.17
Supportive ego-enhancement	31%$_a$	60%$_b$	69%$_b$	17.71***
Dynamic/insight-oriented	0%$_a$	9%$_b$	29%$_b$	15.80***
Symptom-oriented	11%$_a$	40%$_b$	54%$_b$	20.80***
Direct	49%$_a$	37%$_b$	34%$_b$	6.00*
Indirect	42%$_a$	63%$_b$	71%$_b$	7.43*
Permissive	46%$_a$	66%$_b$	74%$_b$	11.29**

*p < .05, **p < .01, ***p < .001
Note: Percentages with different subscripts are significantly different from one another

DISCUSSION

In this study we examined the extent to which the use of hypnotic techniques (i.e., inductions and suggestions) varied as a function of (1) years of experience of the clinician participants, (2) theoretical orientation of the clinician participants, and (3) age of the patient. For the most part, neither the clinician's theoretical orientation nor clinical experience were associated significantly with clinical practice. However, we did identify large effects for patient age for most (17 of 20) of the techniques used.

We reasoned *a priori* that those techniques or strategies that were used more often by the highly experienced than less experienced clinicians might be those that are most effective, given the likelihood that over time clinicians would be rewarded (by observing treatment

benefits) for using the most effective strategies. Although we found two inductions (storytelling, focusing on sensations) to be used more frequently (i.e., at least 20% more), and two (use of games/toys, absorption in breathing) to be used less frequently by the most experienced clinicians, these differences were not statistically significant. It is possible that significant differences would have emerged had the sample size been larger (with an associated increase in power to detect differences). Experimental research would be needed to determine if those that appear to be preferred, especially by the most experienced clinicians (e.g., relaxation, favorite place, storytelling inductions, visualization, storytelling, and indirect suggestions) are indeed those that tend to produce the most benefits. Even so, however, among the most experienced clinicians, there was no induction strategy or suggestion type that was used by fewer than 44%. This suggests that these clinicians find each technique useful for at least some patients. To the extent that continued use of these techniques is an indication that they are found to be useful, the findings suggest that clinicians just starting out should consider learning about each approach, and incorporate them into practice.

Contrary to our expectations, the theoretical orientation of professionals was not associated significantly with the use of any induction strategy or type of suggestion. As it was the case with differences due to clinician experience, there were some inductions and suggestion strategies that evidenced differences of 20% or more between the clinicians with different theoretical orientations. For example, clinicians who endorsed a social-cognitive view of hypnosis reported using more metaphors and sensorimotor inductions, as well as more direct suggestions, while clinicians who endorsed an altered state view reported being more likely to use a focus on sensations as an induction strategy. Whether these differences would emerge in studies with larger sample sizes will require additional research. Nevertheless, for the most part our findings suggest more similarities than differences in the actual practice of hypnosis between clinicians who espouse different theoretical orientations. This raises the

intriguing possibility that, despite some significant discussion and debate over the merits of different theoretical approaches to hypnosis over the years (e.g. Kirsch, 1991; 1995; Barber, 1969; Lynn and Kirsch, 2006; Spanos & Chaves, 1989; Spanos, 1987; Green, 2012; Barber, 1969; Hammond, 2005; Poulsen & Mathews, 2003; Silva & Chaves, 1992), these issues may have little influence on the actual practice of hypnosis.

The largest and most consistent effects to emerge from our analyses were related to the age of the patient. Our findings are consistent with the idea that hypnotherapeutic inductions and suggestions should fit children's developmental stage as well as social-emotional needs (Ollness and Kohen, 1996). So, for example, we found that with respect to hypnotic inductions, clinicians reported using significantly less relaxation, absorption in breathing, metaphors, focusing on sensations, eye fixation, sensorimotor approaches, and counting methods with very young children (3-6 years old) than with older children. These results are in line with empirical evidence relating the developmental stages to the use of hypnotic inductions (Olness and Gardner, 1988). Olness and Kohen (1996) discuss how young children (until middle childhood; i.e., 7 to 11 years old) (1) do not understand complex, paradoxical hypnotic instructions, (2) are unable to produce self-directed, internal fantasy, and (3) often do not engage in eye closure or relaxation. Young children often do not require relaxation to benefit from hypnotic procedures, and some actually prefer an active-alert form of hypnosis (Lynn, Rhue and Kirsch, 2010). On the other hand, the use of favorite place/games, storytelling, and use of games and toys were used significantly less often in adolescents than in younger children. Pop-up books were never used for the oldest ages (i.e., 7-11 years old or 12-18 year olds) suggesting that it may be a relevant induction technique only for very young children. These findings are in agreement with Olness and Gardner (1988) findings.

Hypnotic suggestions such as visualization, supportive ego-enhancement, dynamic/insight oriented, symptom-oriented, indirect, and permission strategies were used less often for younger children, while storytelling and direct suggestions were used less often

for older children. For very young children, direct commands are often preferred, at least at terms of generating compliance, since a child who is given a choice and is still concrete in his/her thinking may refuse the command (Patterson, 2010). Still, all of the inductions and suggestions were used by at least some clinicians for children patients, with the exception of dynamic/insight-oriented suggestions, which were reported to be never used for the youngest patient age group. Consistent with these findings, empirical data substantiate that dynamic methods are used to a somewhat lesser extent in children (Olness and Kohen, 1996).

This study has a number of limitations. First, it had a relatively low sample size. This limited statistical power (ability to detect differences that may in fact exist in the population). It would therefore be useful to replicate the findings in larger samples of clinicians, if possible. In addition, we had a relatively low rate of participation, despite contacting many clinicians world-wide. Thus, the extent to which our findings generalize to the entire population of clinicians who treat children with pain is not clear. Finally, although the survey was reviewed by a number of experienced clinicians to ensure that the most common induction and suggestion techniques were included, we asked about a finite number of techniques. It is possible, even likely, that strategies other than those assessed are used by clinicians who treat children with pain. Future researchers might consider allowing respondents to "write in" additional approaches to help identify these.

Despite the study's limitations, however, the findings provide specific information regarding the use of a number of hypnotic inductions and suggestions clinicians employ when using hypnosis for children with chronic pain. Pain practitioners could benefit from these results in their practice by comparing the strategies they use with those reported here, asking themselves if there are any techniques used by the clinicians in this study that they would like to add to their repertoire. Researchers may use the findings to identify some specific strategies that deserve more empirical attention. For example, we found that relaxation strategies were used by the great majority of both highly experienced and less experienced

clinicians, whereas counting methods were much less likely to be used. This suggests the possibility that relaxation strategies might be more useful than counting strategies; research to test this hypothesis (as well as the relative utility of other inductions) would be very useful, and provide clinicians with empirical guidelines in the selection of hypnotic techniques. Importantly, the findings are consistent with experts who argue that patient age should be taken into account in the selection of inductions and suggestions; clinicians new to the use of these strategies and to working with children should consider this carefully when developing their treatments.

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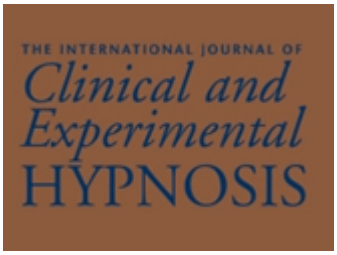
Study IV: Expectancies and hypnotic responsiveness: an experimental design flaw revealed



Expectancies and hypnotic responsiveness: an experimental design flaw revealed

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ABSTRACT

Recent investigations and theories call into question that expectancies about being hypnotized have a determinant role on the hypnotic experience but also at a phenomenological level. We followed an experimental design suitable to analyze the relationship between expectancies about being hypnotized and the phenomenology in hypnosis. This was operationalized with a hypnotic assessment procedure named the Phenomenology of Consciousness Inventory, Hypnotic Assessment Procedure (PCI-HAP). In this investigation two phenomenological variables from the PCI-HAP were used: (1) the PCI altered state of consciousness dimension score and (2) the PCI hypnoidal state score. 115 participants were assigned either to the imagination (hypnosis labeled as imagination) or the hypnosis conditions. Results revealed a minor influence of expectancies and no influence of the label 'hypnosis' across all variables. These findings imply that the methodology commonly used to study the influence of expectancies on hypnotic responsiveness and phenomenology might represent a flaw in favor of a causal relationship between expectancies and hypnotic experience.

Keywords: Hypnosis; Expectancies; Phenomenology; Hypnotic responsiveness

INTRODUCTION

Recent investigations (e.g. Benham, Woody, Wilson & Nash, 2006, Lifshitz, Howells & Raz, 2012) found a small effect of expectancies about being hypnotizable in the hypnotic response, contrarily to what has been proposed by several socio-cognitive researchers (Braffman and Kirsch, 1999; Gandhi & Oakley, 2005; Kirsch, 1985; Lynn, Kirsch & Hallquist, 2007). Socio-cognitive research proposes that hypnotic responding are a product of expectancies (Barber, 1969; for modern analyses, see Braffman & Kirsch, 2001; Kirsch, 2001), and that expectancies have a causal role in the hypnotic response being the sole proximal determinant of hypnotizability (Braffman & Kirsch, 1999; Gandhi & Oakley, 2005; Kirsch, 1985; Lynn, Kirsch & Hallquist, 2008; Kirsch, 2001).

On the other hand, the subjective experience related to hypnosis has received little attention (Barret, 2007; Pekala & Kumar, 2000) and perhaps not in the most appropriate manner (Barret, 2007; Woodard, 2003). Accordingly, a comprehensive hypnotic responsivity assessment methodology should be able to assess hypnotism (i.e. the production, study and use of suggestions). Hence, phenomenology has been explained as a kind of an epiphenomenon related to expectancies (Lynn, Kirsch & Hallquist, 2008; Wagstaff, 2010). For example, Wagstaff (2010) predicted that phenomenology would change in the same direction of responsiveness based on Gandhi and Oakley`s investigation (2005), which did not take into account the hypnotic phenomenology. Therefore, in agreement with the response set theory and, in general, with the sociocognitive perspective, hypnotic experiences occur when expectancies activate a response set for behavior, including phenomenology (Lynn, Kirsch & Hallquist, 2008; Wagstaff, 2010). However, the simple observation of behavior is insufficient to consider that a hypnotic experience has occurred. Consequently, we measured the

phenomenological changes that a person experiences in terms of perception, feelings and emotions with the Phenomenology of Consciousness Inventory (Pekala, 1982). A status of causality should also be attributed to phenomenological variables. Indeed, in a recent clinical research, not published yet, one of the authors of the present study (Ludeña, 2013) found that the level of surprise in respect to the hypnotic experience and the degree of hypnoidal state together explained over 70% of the variance of therapeutic change after hypnosis in people with depression. As a matter of fact, surprise can be defined as an emotion resulting from something that is not expected (i.e. the suggestion response). In some degree, it also includes people whose expectancies are violated. This is contradictory to what has been proposed by Kirsch and colleagues who argued that expectancies are important for its confirmation, contrarily to its violation as advocated by the Discrepancy-Attribution Theory (Barnier, Dienes & Mitchell, 2008).

It also appears important to remark that the type of methodology used in the majority of the studies testing expectancies in the experience of hypnosis may lead to outcomes that overvalue the role of expectancies. A very specific experimental context may result in an overestimation of expectancies, which can represent an experimental design flaw. The methodology established by Kirsch (1991) proposes that expectations should not be assessed before induction as it fails to find strong relationships between expectations and responsiveness. Indeed, Laurence, Beaulieu-Prévost and Chéné (2008) made a number of criticisms on regards of this mentioned methodology, such as the following ones: (1) expectancy is a belief especially based on individual past experiences; (2) thus it is not surprising that expectancies about being hypnotizable can be good predictors of future hypnotic behavior when people evaluate it after experiencing suggestions provided by scales; (3) this prediction is not derived from a causal relation between expectancies and hypnosis, but from a relationship between expectancies and experience (i.e. it is a hypnotic response prediction based on past experiential response to suggestions).

Furthermore, Kihlstrom (2005) also critically evaluated this methodology in which expectancies are measured after participants are first exposed to a hypnotic procedure. For example, Gandhi and Oakley (2005) pursued the following methodological steps in their study: (1) participants were evaluated about their responsivity to suggestions (with the Waterloo Scale-Form C) before a hypnotic induction manipulation; (2) participants were informed that they would be assigned to a group (i.e. hypnosis, relaxation or control) and then assessed again on their responsivity to suggestions (i.e. suggestions were repeated). Additionally, this study also supported the idea that the hypnotic label of a procedure is able to increase responsiveness to hypnosis. However, further evidence still needs to be gathered in order to check the contribution of this type of procedure.

Thus, two main concerns in respect to the type of methodology are related to (1) the moment of assessment of expectancies (measurement of expectancies before and/or after the hypnotic induction) seems to reflect a different relationship between expectancies and hypnotic responsiveness, and (2) the fact, mentioned previously, that the effect of expectancies are tested with much more emphasis in respect to the subjective behavioural response than in relationship to hypnotic phenomenology. Evaluating expectancies over a second hypnotic experience after being exposed to a first experience with suggestions, might simply relate the first performance with the second, without explaining what happened during the first. Furthermore, the assessment of expectancies after hypnotic suggestions can contribute to the fact that the person is fully aware of the benefits achieved via hypnosis, and positive results obtained through hypnosis may motivate and make the person more receptive for the assessment. The study of the nature of hypnosis and responsiveness (including phenomenology) to a hypnotic procedure (or induction) should be done before. In the present study, expectancies were tested long before the participants had been exposed to hypnotic suggestions, ensuring that they did not acknowledge what would happen in both experimental conditions.

Given the above considerations and following the sociocognitive expectancy theory, the crucial prediction from this present study is whether expectancies have an influence on the hypnotic responsiveness, specifically, on its phenomenology (as assessed by the PCI altered state of consciousness and hypnoidal state scores) and whether that influence would be greater in the hypnotic group when compared to the imagination group. Additionally, based on expectancy theory, it is expected that the induction procedure, which was identical for both experimental groups, but with different labels (i.e. hypnosis or imagination), will produce differences between the groups on phenomenology.

METHOD

Research design

This investigation used a between subject design with two experimental conditions: (1) imagination and (2) hypnosis. Participants' expectancies about being hypnotizable and their phenomenology of consciousness (as assessed by the PCI altered state of consciousness and hypnoidal state scores) were evaluated during the investigation in both conditions. Participants in both groups were informed about the type of intervention, which was labeled as hypnosis or as imagination (experimental conditions were identical with exception for the labeling throughout the protocols as either hypnotic or imaginative).

Participants

152 students of the Psychology Course from the University of Coimbra were voluntarily recruited to participate in the present investigation. From the total of 152 participants, 31 participants did not show up on the second phase of the study (see Figure 1), and 6 were excluded for different reasons, such as items not answered, item responses in an unreliable way or participants that manifested suspicion related to the experiment being about hypnosis

(for group imagination before beginning the experiment itself). On the total, 115 participants (101 females; 14 males) took part in this investigation and were aged between 19 and 56 years old (M= 24 years old; SD= 7, 90) (see Table 1) .

Procedure

This present study included different phases (see Figure 1). During phase one, 152 participants were informed that this study was about psychometric proprieties of several instruments. For this reason some weeks later they would be invited to complete the same scales. Instruments were the following ones: the Zung Self-Rating Anxiety Scale-SAS, the Centre for the Epidemiological studies-Depression (CES-D), the Valencia Scale of Beliefs and Attitudes about Hypnosis-client version (VBAHS-C), and the pre assessment form of the Phenomenology of Consciousness Inventory Hypnotic Assessment Procedure (PCI-HAP) by Pekala et al. (2010a, b) to measure expectancies about being hypnotized (expectancy scale obtained from the PCI-HAP). Only after signing the consent form in which participants agreed to enroll in the present investigation, research proceeded to the second phase.

In the second phase (between two and four weeks after phase one) 115 participants were randomly assigned to the hypnosis or imagination conditions. This temporal procedure (i.e. between two and four weeks time) was undertaken to maintain participants' naive experience without receiving any information that could influence their response to the experimental conditions. This precluded any connection between both phases one and two to be detected, and therefore, on phase two, it was reinforced to participants the aim of the current study; i.e. the study of psychometric properties of a number of psychological scales. In respect to the assignment of condition, in order to avoid the possibility of disclosure of the real nature of the present investigation, the first group of participants to be assigned was the imagination group. Only after that, participants of the other experimental condition (i.e. hypnosis) were included. The imagination group was constituted by 3 subgroups (20 +20 +20)

of a total of 60 participants, while the hypnosis group was composed by 3 subgroups (18 +18 +19) of a total of 55 participants. Participants in the imagination condition were firstly informed that the aim of this research was the study of individual differences in imagination and all words related to hypnosis were substituted by words associated with imagination during the hypnotic procedure (e.g. imagine, imagination, images). For example, "*You will always hear me no matter how relaxed, how calm, how deeply in imagination you are*". On the other hand, participants in the hypnosis condition were informed that the present research intended to study individual differences in the experience of hypnosis. Terms of hypnotic nature (e.g. trance) were not referred to, and the Pekala's (audio taped) procedure which has no mention of such concepts was then presented.

In this phase, all participants were exposed to the Hypnotic Assessment Procedure (HAP) and then given the Phenomenology of Consciousness Inventory (PCI) by Pekala et al. (2010a, b) to retrospectively complete in reference to a two-minute sitting quietly period embedded in the HAP in agreement with Pekala et al.'s administration manual (2009). Participants were asked if they had been hypnotized before and also about their expectancies about being hypnotized in the future and to what extend (in the original HAP – induction procedure this is done before induction, however in this version of HAP- induction procedure - we did not use the expectancy`s scale right before the induction). In this phase, the scale was only used at the end of the PCI. On addition, participants completed once again the same psychometric personality scales measuring anxiety, depression, and beliefs and attitudes towards hypnosis. Because of the nature of the present work, at the end of the experiment there was no debriefing or explanations in respect to the same.

Figure 1. Procedure phases of the study

PHASE I WEEK 1	ADMINISTRATION OF PSYCHOMETRICS AND EXPECTANCIES N= 152 Administered the following personality scales Zung Self-Rating Anxiety Scale-SAS, Centre for the Epidemiological studies-Depression (CES-D), Valencia Scale of Beliefs and Attitudes about Hypnosis-client version (VBAHS-C), and a measure of expectancies about being hypnotized (expectancy scale was obtained from the PCI HAP – pre-assessment)
PHASE II BETWEEN WEEK 2 AND 4	RANDOM ASSIGNMENT OF CONDITION (after signing the consent form) N= 115 Subjects were randomly assigned to either the imagination condition of to the hypnosis condition
	IMAGINATION CONDITION ADMINISTERED N= 60 Subjects assigned to the imagination condition were told they would be administered an imagination procedure (i.e. they were not informed they were being subjected to a hypnotic procedure). They were administered the HAP- induction procedure- and then the PCI procedure by Pekala. All words related to hypnosis were substituted by words associated with imagination (e.g. imagine, imagination, images). Scales administered: the expectancy scale about being hypnotized (obtained from the PCI HAP pre-assessment), Zung Self-Rating Anxiety Scale-SAS, Centre for the Epidemiological studies-Depression (CES-D), and Valencia Scale of Beliefs and Attitudes about Hypnosis-client version (VBAHS-C).
	HYPNOSIS CONDITION ADMINISTERED N= 55 Participants in the hypnosis condition were informed that the present research intended to study individual differences in the experience of hypnosis They were then administered the HAP- induction procedure- and PCI procedure by Pekala. Scales administered: the expectancy scale about being hypnotized (obtained from the PCI HAP pre-assessment), Zung Self-Rating Anxiety Scale-SAS, Centre for the Epidemiological studies-Depression (CES-D), and Valencia Scale of Beliefs and Attitudes about Hypnosis-client version (VBAHS-C).

Measures

This study used a number of scales as mentioned before, such as the Zung Self-Rating Anxiety Scale (Zung, 1979; Ponciano, Serra & Relvas, 1982), the Centre for the Epidemiological studies-Depression (CES-D, Radloff, 1977; Fagulha & Gonçalves, 2000), and the Valencia Scale of Beliefs and Attitudes about Hypnosis-client version (VBAHS-C, Carvalho, Capafons, Kirsch, Espejo, Mazzoni, & Leal, 2007). Expectancies about being hypnotized were measured with the pre-assessment form of the Phenomenology of Consciousness Inventory - Hypnotic Assessment Procedure PCI-HAP by Pekala (2010a, b). Hence, a Likert scale ranging from 1 to 10 was used (e.g. “I would like to know how deeply hypnotized you expect to be when we try to hypnotize you.”1" = "not hypnotized at all" to "10" = "the most hypnotized that you can imagine"). The HAP includes several sections, such as relaxation instructions (called a “body scan”), a hypnotic induction procedure (called a “mind calm”), and suggestions to have a vivid hypnotic dream. It includes as well an extra item to evaluate the imagery vividness dream.

he PCI is composed of 53 dipole items separated by a 7-pont Likert scale of 0 to 6 (for example: 0- I felt very calm (0 1 2 3 4 5 6), 6- I felt very anxious”) presenting two extreme affirmations in which the participant must choose the one that best related to his or her experience. The PCI generates 12 dimensions: (1) positive affect, (2) negative affect, (3) altered experience, (4) rationality , (5) visual imagery, (6) volitional control, (7) attention, (8) self-awareness, (9) arousal, (10) altered state of awareness, (11) internal dialogue , and (12) memory (there are 14 additional subdimensions that are not considered in the present study). The PCI was adapted to the Portuguese population. This version was presented in the doctoral thesis of one of the authors (Ludeña, 2013). It was considered an appropriate instrument to measure the phenomenology after a hypnotic induction with an internal consistency of α= 0.77, and the correlation between the test-retest items with values between 0.898 and 0.986, showing a good temporal stability evidence scale.

It is important to mention that the PCI dimension, altered state of consciousness, assesses whether the participants feels themselves to be in an extraordinarily unusual and uncommon state of awareness or if their state of consciousness is not different than usual. It, accordingly to Pekala (2009), accounts for 15% of the variance of the total hypnoidal state score (see below). The PCI also generates a measure called a hypnoidal state (or trance state) score, also called a predicted Harvard Group Scale (pHGS) score. It is based on a regression equation using the ten dimensions of PCI (Pekala & Kumar, 1984, 1987) to predict the total Harvard Group Scale (Shor & Orne, 1962), and is used as a means to measure the depth of "hypnosis," à la Weitzenhoffer (2002). . The hypnoidal state score, obtained with the PCI, has a validity coefficient of 0.86 on the Stanford Hypnotic Susceptibility Scale: Form A, and between 0.62 and 0.67 on the Harvard Group Scale of Hypnotic Susceptibility: Form A (data provided in Pekala & Kumar, 2007). As Pekala et al. (2009, p 4-5) stated: "The hypnoidal state score gives a measure of trance depth or what Weitzenhoffer (2002) would call "hypnosis". Being normed against the Harvard scale, the hypnoidal state score is considered a quantitative measure of "trance depth" (Pekala et al., 2009).

Data analyses

The one-way analysis of variance (ANOVA) was conducted in order to compare all the variables. Additionally, effect sizes were calculated allowing us to ascertain relevant changes that had occurred throughout the investigation. Therefore, in the present research, besides obtaining p values, we considered as differences of interest only those that were represented by medium and large effect sizes (*Omega squared*). When p> 0. 05, effect sizes were not reported. The magnitude of effect sizes were based on Kirk`s criteria (1996): small (0.01), medium (0.06) and large effect sizes (0.14). Finally, Pearson r correlations were computed to also explore the relationship between the phenomenological variables (i.e. altered state of consciousness and hypnoidal state) in both experimental conditions.

RESULTS

Expectancies about being hypnotized: phenomenological altered state of consciousness and phenomenological hypnoidal state

In order to elucidate if the level of expectancies could have influenced the phenomenological dimension altered state of consciousness and hypnoidal state, three levels of expectancy were constituted: high (scores 8,9,10), moderate (scores 4,5,6,7), and low (1,2,3) (see Table 1), also considering the experimental conditions. Thus, a two-way ANOVA with level of expectancy as a one factor and the experimental condition as the other factor was conducted. There was a statistically significant interaction effect between group and expectancies, $F(2, 109)= 3.25$, $p< 0.05$, but with no statistically significant main effect for level of expectancy for hypnoidal, $F(2, 109)= 3.03$, $p> 0.05$. Additional analyses were conducted to explore the nature of the interaction effect found, using a one-way ANOVA. So, for the imagination group, no differences were found in the phenomenological variable altered state of consciousness between participants of low, moderate and high expectancies ($F= 1.67$, $p> 0.05$). The same statistical test revealed, in the hypnosis group, no significant statistical difference in the altered state of consciousness ($F= 2.96$, $p> 0.05$).

However, results for the imagination group revealed a significant difference in the phenomenological variable hypnoidal state between participants of low and both moderate and high expectancies ($F= 6.00$, $p< 0.005$) with a large effect size (0.18). Results for the hypnosis group revealed no significant differences in the phenomenological variable hypnoidal state between groups ($F= 0.35$, $p > 0.05$). In sum, only the phenomenological variable hypnoidal state produced differences in the imagination group with a large effect.

Table 1. Mean rating scores and Standard Deviations for altered state of consciousness and hypnoidal state variables for the imagination and hypnosis groups and levels of expectancies.

Groups	Phenomenological variables	Level of Expectancies before	N	Mean	Std. Deviation
Imagination	Hypnoidal State	Low	12	3.92	1.16
		Moderate	42	5.13	1.10
		High	6	5.14	0.59
	Altered State of Consciousness	Low	12	2.55	1.09
		Moderate	42	3.08	0.76
		High	6	3.16	1.13
Hypnosis	Hypnoidal State	Low	10	5.12	0.69
		Moderate	32	5.11	0.72
		High	13	5.04	1.44
	Altered State of Consciousness	Low	10	2.13	1.16
		Moderate	32	3.07	1.28
		High	13	3.35	1.21

Furthermore, a one-way analysis of variance between groups was conducted to explore possible differences in the phenomenological variables hypnoidal state and altered state of consciousness between the two experimental groups (see Table 2). No significant statistical

differences were found for hypnoidal state F (2, 114)= 1.07, p> 0.05, and altered state of consciousness F (2, 114) = 0.01, p> 0.05 in both groups.

Table 2. Mean rating scores and Standard Deviations for altered state of consciousness and hypnoidal state variables in the imagination and hypnosis groups.

Groups	Phenomenological variables	N	Mean	Std. Deviation
Imagination	Hypnoidal State	60	4.89	1.16
	Altered State of Consciousness	60	2.98	0.88
Hypnosis	Hypnoidal State	55	5.1	0.91
	Altered State of Consciousness	55	2.96	1.29

Correlations

We also computed the correlations between expectancies and the hypnoidal and altered state of consciousness scores for each experimental condition. With the imagination group only the variable hypnoidal state was found to have a moderate and significant correlation with expectancies (r= 0.42; p< 0.01); while in the hypnosis groups only the variable altered state of consciousness was moderately and significantly correlated with expectancies (r= 0.32; p< 0.01). Fisher's Z' test found no statistical significant differences between the two experimental conditions in altered state of consciousness (Z=-0.89, p>0.05), but a statistical significant difference in hypnoidal state (Z=2.1, p< 0.01). These findings are consistent with the ANOVA results.

DISCUSSION

As mentioned in the introduction, the same socio-cognitive theory that emphasizes the importance of expectancies on responsiveness also predicts this same role at the phenomenological level (e.g. Kirsch, 1985; Lynn & Kirsch; 2006; Lynn, Kirsch & Hallquist, 2008; Wagstaff, 2010). According to the response expectancy theory of hypnosis, hypnotic phenomena are fundamentally genuine and occur simply because subjects expect them to occur (Wagstaff, Toner and Cole, 2002). Therefore, following the sociocognitive perspective and concerning our experiment, it would be expected that: (1) the hypnosis group would have more significant changes in phenomenology compared to the imagination group, (2) within the hypnosis group, participants with high expectancies about being hypnotized would have high scores in the hypnoidal state and altered state of consciousness, and finally, (3) within the imagination group there would be no differences between participants in relation to their expectancies and phenomenology. Our results disconfirm the hypotheses based on the theory of expectancy.

However, when comparing different levels of expectancies (i.e. low, moderate and high) in each experimental group, findings show that only in the imagination group, participants with low expectancies had significantly lower hypnoidal state scores than the participants with high and moderate expectancies (which is reflected in a moderate correlation between expectancies and hypnoidal state in this group). Participants with high expectations in both groups did not reveal higher scores in the altered state of consciousness when compared to participants with low or moderate expectancies. Furthermore, the statistically significant correlation, but moderate, found between expectancies and altered state of consciousness, in the hypnosis group, is not contrary to these findings as the Fisher`s Z test pointed insignificant difference between both groups on such variable. This same test found differences for the other phenomenological variable in study, i.e. hypnoidal state, which is in consonance with the ANOVA results.

Surprisingly, expectancies produced a stronger effect on the phenomenological variable hypnoidal state in the imagination condition than in the hypnosis condition. This is a very intriguing finding taking into account that the hypnoidal state is considered an objective measure of "trance depth" (Pekala et al., 2009, 2010a). Therefore, an interesting question concerns why we obtained this data in the imagination group and not in the hypnosis group. Bearing in mind that participants of the imagination group did not acknowledge that they were being subjected to a hypnotic procedure this could be associated with a "surprise effect". Thus, this "surprise effect" may be based on a violation of expectancies, i.e. individuals who participate in an experiment about individual differences in imagination do not expect the occurrence of unusual subjective experiences. These results are in line with the Discrepancy-Attribution Theory (Barnier, Dienes and Michell, 2008) proposing that the hypnotic response occurs with the violation of expectancies (and not with its confirmation). Further, a recent unpublished study suggests that a surprise effect may be related to the violation of expectancies (Ludeña, 2013). Moreover, different factors, as individual differences (e.g. fantasy-prone or amnesia-prone individuals) also contribute to the phenomenology and responsiveness to hypnosis as advocated, among others, by Barber (1999), Laurence et al. (2008) and Pekala (2011).

Furthermore, our research also assessed the possible effect of the hypnotic label on the phenomenological variables (our second prediction based on the expectancy theory) since findings from previous research (Gandhi & Oakley, 2005) point to the labeling of a procedure as "hypnosis" as a relevant factor influencing the hypnotic phenomenology. Nevertheless, the present results evidenced that labeling a procedure as hypnosis did not have an effect on either the altered state of consciousness or in the hypnoidal state score, i.e. the procedure produced no effect on the mentioned phenomenological variables when it was called as "hypnosis" or "imagination". Thus, despite methodological differences between this study and the Gandhi and Oakley`s study (2005), as described at the introduction, labeling of the

procedure did not emerge as an important factor influencing the hypnotic phenomenology contrarily to what is suggested by Wagstaff (2010).

The results from this present investigation give support to a number of criticisms concerning the methodology generally used by socio-cognitive research (Laurence et al., 2008; Kihlstrom, 2005), which we believe overemphasizes the role of expectancies about being hypnotizable on the responsiveness and phenomenology of hypnosis. By using a methodology in which participants do not know that they will be presented with a hypnotic procedure, we reached results that we may say, at least, are not supportive of expectancy theory. We also would like to call attention to the importance of measuring phenomenological constructs when looking at the effect of the expectancies about being hypnotized. For example, Wagstaff et al. (2008), suggested that depth scales may serve as a useful alternative to conventional suggestion-based tests of hypnotizability.

The present investigation also had some methodological limitations, such as the fact that participants were all students, and a small sample size. Nevertheless, it employed a different methodology and measurement from previous studies in order to test the role of expectations in hypnotic responsiveness and associated phenomenology. As we stipulated in the introduction, the present findings are in line with recent theories of hypnosis (Barnier, Dienes, & Mitchell, 2008).. Further research on this matter should carefully take into account the aforementioned phenomenological methodological and empirical considerations when studying the effect of expectancies about being hypnotized.

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V. GENERAL DISCUSSION

In this section we summarize the results of our studies. The presentation is not intended to be exhaustive; a complete description of what was observed is to be found in each of the articles included in this dissertation. Each study will be including a discussion on main findings.

Study I. Tomé-Pires, C and Miró, J (*in press*). Electrodermal responses and memory recall in migraineurs and headache-free controls. *European Journal of Pain*

We were not able to confirm a specific electrodermal sensitization to pain-related words in our sample of migraineurs as showed in previous research (Jamner & Tursky, 1987), and in other chronic pain conditions (e.g., back pain, irritable bowel syndrome) (Chapman & Martin, 2011; Flor et al., 1997; Salamy et al., 1983). Likewise, we did not find a specific electrodermal sensitization to negative emotional words in our sample of migraineurs. However, the results of this study revealed that electrodermal activity induced by pain descriptors and emotional words were very similar to each other and significantly larger than those induced by neutral words. These findings are in line with a previous published work (Bonnet & Naveteur, 2006) implying that chronic pain may be linked to an increased reactivity to a wide range of stimuli. Findings suggest that in migraine, not only pain-related but also negative emotional stimuli may have a threatening value functioning as potential triggers. Recall of negative emotional words was significantly different between experimental groups: migraineurs immediately recalled more emotional words than headache-free controls. Findings suggest a possible memory bias, not for pain-related words, but for emotional words in migraineurs. This is also in line with previous studies showing that words whose emotional content is congruent with the patient's pain status and emotional state may be more likely to be remembered (Asmundson et al., 1997; Keogh et al., 2001; Pearce et al., 1990).

Emotional words, as revealed by our findings (on memory recall), may lead to memory biases in migraine patients. The importance of emotional triggers (Andress-Rothrock et al.,

2010; Puschmann & Sommer, 2011) and their link to migraine may explain why migraineurs are susceptible not only to pain but also to negative emotional stimuli. This data interpretation is based on the assumption that it may be the case that emotional words (emotional stimuli) and also emotional states, as negative affect, may act as migraine triggers (Andrasik et al., 2010; Janseen, 2002; Puschmann & Sommer, 2011).

Further analyses on the relationship between memory recall and the psychological variables (i.e. anxiety and depression) and pain fear cognitions (i.e. catastrophizing) revealed that both anxiety and catastrophizing produced significant differences between migraineurs and headache-free controls: migraineurs were significantly more anxious and greater pain catastrophizers. Literature points the relevance of both variables in the experience of pain: while anxiety states have shown to be associated with increased attention to threat and negative stimuli (e.g., Mathews & Mackintosh, 1998; Rutherford et al., 2004), pain catastrophizing has been demonstrated to be a strong predictor of chronic pain associated with anxiety and pain vigilance in people with chronic pain (Roelofs et al., 2002; Goubert et al., 2004). In this study, pain catastrophizing was related to memory recall (and also related to anxiety), which gave support to our prediction about the relationship between memory recall and pain fear cognitions (i.e. catastrophic thinking).

Study II. Tomé-Pires, C and Miró, J (2012). Hypnosis for the management of chronic and cancer procedure-related pain in children. *International Journal of Clinical and Experimental Hypnosis* 60: 4, 432-457

The objective of this study was to review the empirical evidence about the use of hypnosis in the management of children and adolescents with various chronic pain problems. This review revealed that although available studies demonstrated the efficacy of hypnosis as a pain control technique in pediatric populations, there is a great need for additional controlled studies looking into the effectiveness of hypnosis as a pain control technique for pediatric pain. Hypnosis proved to be significantly more effective at reducing pain than no treatment (Hawkins et al., 1998; Liossi & Hatira, 2003; Olness et al., 1987; Zeltzer & LeBaron, 1982), attentional control conditions (Liossi & Hatira, 2003; Liossi et al., 2006, 2009), medication (Olness et al., 1987), standard medical care (Liossi & Hatira, 1999, 2003; Liossi et al., 2006, 2009; Kuttner et al., 1988; Vlieger et al., 2007), and as an adjunct to other treatments (Liossi & Hatira, 2003; Liossi et al., 2006, 2009). However, results were less consistent when hypnosis was compared to play (Katz et al., 1987), distraction (Kuttner et al., 1988; Smith et al., 1996; Wall & Womack, 1989; Zeltzer & LeBaron, 1982) or cognitive-behavioural coping skills intervention (Liossi & Hatira, 1999). These findings on the efficacy of hypnosis are in agreement with previous clinical reports on adult chronic pain (e.g. Hammond, 2007; Jensen & Patterson, 2006; Montgomery et al., 2000).

This review also revealed that a number of studies reported hypnotizability as a predictor of positive treatment outcomes. Patients with the highest level of hypnotizability got the most benefit both immediately after the treatment and at follow-up (Liossi et al., 2006; Smith et al., 1996). These results converge with the findings of the meta-analysis on adult hypnosis conducted by Montgomery and colleagues (2000), which concluded that hypnoanalgesic effects differ according to levels of hypnotic suggestibility; that is to say,

individuals with higher levels of suggestibility experience greater pain relief. Further studies are needed to clearly determine whether hypnotizability is a good predictor of outcomes.

The analysis on the components that make up the successful hypnotic protocols reported less clear results. Although we found that protocols mostly focused on imaginative involvement and used similar hypnotic induction procedures (i.e., relaxation or ideomotor techniques, such as arm levitation or eye fixation), we were not able to clarify the number of sessions and/or duration of sessions needed for hypnosis. Essentially, hypnosis was administered by trained therapists but was unclear if the way in which hypnosis was administered made any difference to the results. Findings of this review also revealed that there were age and gender effects when using hypnosis: girls (Katz et al., 1987), younger children (Kuttner et al., 1988), and children with initial high levels of pain (Wall & Womack, 1989) may benefit the most from hypnotic treatment.

Study III. Tomé-Pires, C, Solé, E, Racine, M, de la Vega, R, Castarlenas, E, Jensen, MP, Miró (*2014*). Use of hypnotic techniques in children and adolescents with chronic pain: do age of patients, and years of practice and theoretical orientation of clinicians matter? Submitted to *International Journal of Clinical and Experimental Hypnosis*

In this study, we conducted an online survey addressed to health care professionals using hypnosis in the treatment of pediatric chronic pain. It aimed to obtain information on their use and selection of hypnotic techniques (i.e. induction and suggestions). Specifically, this work reports on whether hypnotic inductions and suggestions were different depending on the theoretical orientation and clinical experience (i.e. years of hypnosis practice of clinicians), and on the age of pediatric chronic pain patients. Findings revealed that neither the theoretical orientation nor the clinical experience had a significant influence on the use and selection of hypnotic techniques. Contrarily, we found large effects for patient`s age for the majority of hypnotic techniques.

In respect to years of practice with hypnosis of health professionals we expected an influence on the selection of hypnotic techniques as more experienced professionals would be rewarded (by observing the effects) to use the most effective strategies. Although we found two inductions (storytelling, focusing on sensations) to be used more frequently (i.e., at least 20% more), and other two (use of games/toys, absorption in breathing) to be used less frequently by the most experienced clinicians, these differences were not statistically significant. Nevertheless, there was no induction strategy or suggestion type that was used by fewer than 44%, which suggests that these clinicians find each approach useful for at least some young patients, and that each should be considered, as appropriate. On addition, and contrarily to our expectations, the theoretical orientation of professionals was not significantly associated with any hypnotic techniques. Some induction and suggestion strategies evidenced differences of 20% or more between clinicians with distinct orientations; for example,

clinicians endorsing a social-cognitive orientation used more metaphors and sensorimotor inductions, whereas clinicians endorsing an altered state orientation were more likely to use focus on sensations as an induction. For the most part, our outcomes suggest more similarities than differences among clinicians holding different theoretical orientations.

Finally, in relation to the age of the patient, we found significant differences in hypnotic inductions, such as: relaxation, absorption in breathing, metaphors, focusing on sensations, eye fixation, sensorimotor approaches, and counting methods, were used significantly less often as inductions with very young children (3-6 years old) than older children. These results are in line with empirical evidence relating the developmental stages to the use of hypnotic inductions (Olness & Gardner, 1988). On the other hand, the use of favourite place/games, storytelling, and use of games and toys, pop-up books was used significantly less often in adolescents than in younger children. Pop-up books were never used for the oldest ages (i.e., 7-11 year olds or 12-18 year olds). With respect to hypnotic suggestions, visualization, sensorimotor, supportive ego-enhancement, dynamic/insight oriented, symptom-oriented, indirect, and permission strategies were proved to be less often used for younger children, while storytelling and direct suggestions were used less often for older children. For very young children, direct commands are often preferred, at least in terms of generating compliance. A child who is given a choice and is still concrete in his/her thinking may refuse the command (Patterson, 2010). Our findings are in line with these ones. Still, all of the inductions and suggestions are used by at least some clinicians for children clients/patients, with the exception of dynamic/insight-oriented suggestions, which were reported to be never used for the youngest (3-6 year old) patient age group. Empirical data substantiate that dynamic methods are used to a somewhat lesser extent in children (Olness & Kohen, 1996).

The present study provides specific data on the frequency of use of a number of hypnotic techniques clinicians use when delivering hypnosis in youth. For example, relaxation strategies

were used by the great majority of both highly experienced and less experienced clinicians, whereas counting methods were much less likely to be used. This suggests the possibility that relaxation strategies might be more useful than counting strategies; research to test this hypothesis (as well as the relative utility of other induction procedures) would be very useful, and provide clinicians with empirical guidelines in the selection of hypnotic techniques. Furthermore, outcomes suggest that age-tailored techniques should be encouraged in clinical practice.

Study IV. Tomé-Pires, C, Ludeña, MA and Pires, CL (*in press*). Expectancies and hypnotic responsiveness: an experimental design flaw revealed. *International Journal of Clinical and Experimental Hypnosis, 3rd revision.*

In this study we intended to test the value of expectancies on hypnosis, specially focusing on the relationship between expectancies about being hypnotized and the phenomenology in hypnosis (i.e. altered state of consciousness and hypnoidal state), which has been rarely put into relation (i.e. phenomenological measurement of hypnotic responsivity). We found that overall expectancies (measured before the experiment) did not have an influence on the phenomenological experience of hypnosis. Wagstaff et al. (2008) suggested that depth scales may serve as a useful alternative to conventional suggestion-based tests of hypnotizability. Based on this data, our phenomenological assessment intended to determine how well self-reported hypnotic depth and altered state effects could be predicted from expectancies, variables implicated in hypnotism by many theorists and researchers (Pekala, 2010).

Significant differences only emerged on the hypnoidal state between participants of low and both moderate and high expectancies in the imagination group (i.e. lower expectancies, lower hypnoidal state). It was surprising that expectancies produced a stronger effect on the phenomenological variable hypnoidal state in the imagination condition rather than in the hypnosis condition. This is a very intriguing finding as hypnoidal state is considered an objective measure of "trance depth" (Pekala et al., 2009, 2010a). Bearing in mind that participants of the imagination group did not acknowledge that they were being subjected to a hypnotic procedure this could be associated with a "surprise effect". Thus, this "surprise effect" may be based on a violation of expectancies, i.e. individuals who participate in an experiment about individual differences in imagination do not expect the occurrence of unusual subjective experiences. These results are in line with the Discrepancy-Attribution

Theory (Barnier et al., 2008) proposing that the hypnotic response occurs with the violation of expectancies (and not with its confirmation). On the other hand, this study also showed that when hypnosis is labelled as “hypnosis” there is no influence on the hypnotic phenomenology contrarily to what is suggested by Wagstaff (2010). The hypnotic procedure produced no effect on the phenomenological variables when it was called “hypnosis” or “imagination”, contrarily to evidence claiming the importance of the label “hypnosis”; i.e. hypnotic context; as it may have an impact on the effectiveness of hypnosis (e.g. Milling & Constantino, 2000; Gandhi & Oakley, 2005).

VI. CONCLUSIONS

CONCLUSIONS

1. Migraine is a pain experience that implies emotional processing of a wide range of stimuli. Of fundamental interest is: (1) altered cognitive processing (also attentional and memory biases) may have a relevant role in the maintenance and chronification of migraine; (2) the personal relationship between pain descriptors, emotional words and migraineurs, which may lead to highly specific conditioning and sensitization. Avoidance of personal trigger factors (e.g., emotional or pain-related stimuli) may explain the process of migraine chronification since it increases sensitivity to the triggers and leads to an increased probability of migraine attacks in response to triggers. Interventions could aim to target problematic pain-related memories influencing the perception of migraine pain and pain-related physiological responses (Rainville et al., 2005) since pain-increasing mechanisms appear to play a relevant role in the process of migraine chronification. Additionally, migraine treatment would benefit from understanding that psychological factors (e.g. catastrophizing, anxiety, emotional stress) contribute to headache in various ways, as for example: (1) triggering factors, (2) maintaining factors, and (3) exacerbating factors (Andrasik et al., 2011).

2. Hypnosis proved to be an effective technique for the management of pediatric chronic pain and therefore can be recommended as a pain control technique for this population. Hypnosis was similarly employed among the clinical trials (in terms of its content), with differences emerging when comparing the implementation and dose treatment (e.g., number and duration of sessions). Hypnotizability seems to be playing a role in the positive results shown by hypnosis.

3. Health care professionals seem to agree on the type/nature of hypnotic techniques (induction and suggestions) when applied to certain age groups. Hypnotic techniques

are selected as a function of the age of patients, which reveals that professionals take into account the developmental stage of young patients, and that the efficacy of hypnotic techniques depends, at least to certain extent, on the age of the child. Age-tailored techniques should be encouraged in clinical practice of hypnosis.

4. Expectancies, when measured before the subject has been exposed to hypnosis, did not prove to have a determinant role in explaining the hypnotic phenomenology (i.e., the hypnoidal state and altered state of consciousness). Further research is warranted to confirm the role of expectancies in the phenomenological experience of hypnosis.

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