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Differential effectiveness of psychological interventions for reducing osteoarthritis pain: a comparison of Erickson hypnosis and Jacobson relaxation

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The present study investigates the effectiveness of Erikson hypnosis and Jacobson relaxation for the reduction of osteoarthritis pain. Participants reporting pain from hip or knee osteoarthritis were randomly assigned to one of the following conditions: (a) hypnosis (i.e. standardized eight-session hypnosis treatment); (b) relaxation (i.e. standardized eight sessions of Jacobson's relaxation treatment); (c) control (i.e. waiting list). Overall, results show that the two experimental groups had a lower level of subjective pain than the control group and that the level of subjective pain decreased with time. An interaction effect between group treatment and time measurement was also observed in which beneficial effects of treatment appeared more rapidly for the hypnosis group. Results also show that hypnosis and relaxation are effective in reducing the amount of analgesic medication taken by participants. Finally, the present results suggest that individual differences in imagery moderate the effect of the psychological treatment at the 6 month follow-up but not at previous times of measurement (i.e. after 4 weeks of treatment, after 8 weeks of treatment and at the 3 month follow-up). The results are interpreted in terms of psychological processes underlying hypnosis, and their implications for the psychological treatment of pain are discussed.

KEYWORDS: hypnosis, relaxation, mental imagery, osteoarthritis, elderly, pain.

INTRODUCTION

Osteoarthritis (OA) is considered a common disease, especially among the elderly population. This pathology is defined by cartilage erosion, enlargement of bones and production of excrescences, which often lead to disability in the long run. Pain is the primary symptom of this disease. As life expectancy increases, so does the number of people suffering from joint disease and especially from OA. Despite the high prevalence of OA, no specific treatment is currently available. Drug therapies for older adults primarily affected by OA are limited owing to side-effects. Likewise, surgical approaches, such as joint replacement surgery, are not without risk and are usually reserved as a last resort for severe pain (Turner and Keefe, 1999).

One approach to OA treatment is to consider psychological techniques that aim at alleviating subjective pain. It is now well recognized that pain has psychological components and consists in a multidimensional experience. Sensory processes refer to the quality, intensity and spatiotemporal characteristics of the sensation, while affective and motivational processes refer to its negative valence and aversiveness (Melzack and

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Wall, 1965, 1988; Melzack and Casey, 1968; Price, 1988). In addition, cognitive activity, which includes social and psychological variables concerning the situation, modulates these processes while autonomic and behavioural responses are conceived as output processes that may produce feedback modulation. These considerations have led to a biopsychosocial perspective of pain and to psychological interventions (e.g. Craig, 1994; Fernandez and Turk, 1992; Arena and Blanchard, 1999).

Psychological interventions have found interesting applications in OA. It has been shown that older adults with OA of the knee vary considerably with respect to the use and perceived effectiveness of pain-coping strategies and that these strategies are related to pain and disability (Keefe *et al.*, 1987). Pain perception can be altered using cognitive behavioural interventions (CBT) that aim at improving self-efficacy in managing pain and disability (Bandura, 1991). These interventions involve relaxation, activity pacing, goal setting, imagery, cognitive restructuring, problem solving and lifestyle change. They have been proven effective in reducing pain perception and psychological disability compared with standard-care control conditions. The results are usually long lasting, remaining significant several months after the treatment (Basler, 1989; Keefe *et al.*, 1990a,b).

Studies on the effect of educational programmes on OA patients (arthritis self-management programmes) have also shown significant effects for symptom management. These techniques also aim at improving self-efficacy. They are similar to CBT, although they provide more formal information to participants (about arthritis, exercise, pain management, depression, nutrition, communication with health professionals and family) (Barlow *et al.*, 1997, 1998, 1999). One study comparing the effectiveness of CBT and educational programmes observed a greater efficacy of the former (Keefe *et al.*, 1990a), whereas the second showed no difference after 1 year follow-up (Calfas *et al.*, 1994). These observations are only preliminary, however, and need to be replicated.

Thus, it is clear that psychological interventions affect the level of pain in OA patients and that these interventions are effective in treating OA. However, existing research has not yet established whether all components of these interventions are necessary for the intervention to be effective or whether effectiveness is due to some specific components. Future studies should establish the active ingredients of effective interventions.

In addition, some types of interventions, proven effective to reduce pain in other conditions, have not been tested for treating OA pain. For instance, it is surprising that the efficacy of hypnosis for OA pain relief has not been studied, despite the fundamental and clinical research evidence that hypnosis affects pain. Indeed, fundamental research has established that hypnosis is efficient as a cognitive intervention to produce analgesia (Hilgard, 1975; Hilgard and Hilgard, 1975; Sheehan and Perry, 1976; Girodo and Wood, 1979; Spanos *et al.*, 1984, 1985, 1990; Tripp and Marks, 1986; Stam *et al.*, 1984; Elton *et al.*, 1988; Zeltzer *et al.*, 1989; Baker and Kirsch, 1993; Chaves, 1999; Zachariae and Bjerring, 1994, Montgomery *et al.*, 2000) and to alter pain perception—hypo- and hyperalgesia (Meier *et al.*, 1993) or to decrease or increase pain threshold (Arendt-Nielsen *et al.*, 1990)—as well as to differentiate dimensions of pain (Houle *et al.*, 1988; Malone *et al.*, 1989; Price, 1996; Price and Barber, 1987; Rainville *et al.*, 1999). Further, Kiernan *et al.*, (1995) report that hypnosis has a measurable physiological effect in modifying pain level. This suggests that subjective reports may reflect the physical consequences of an effective intervention. However, the biological basis of the hypnotic processes remains contested (e.g. Wagstaff, 1999) and further investigations are needed.

The effectiveness of hypnosis for pain relief has also been tested in clinical research. In addition to numerous case reports indicating the effectiveness of hypnosis in pain relief (e.g. Barber *et al.*, 1996; Covino and Frankel, 1998; Chaves, 1999), several controlled clinical trials have been conducted using hypnosis for pain control. Clinical studies in dentistry (Stam *et al.*, 1984; Enqvist and Fisher, 1997), burn treatment (Wakeman and Kaplan, 1978; Patterson *et al.*, 1989, 1992; Patterson and Ptacek, 1997), surgery (Lambert, 1996; Faymonville *et al.*, 1997; Mauer *et al.*, 1999) and radiology (Lang *et al.*, 1996) have indicated

that this technique is effective in both acute and chronic pain. It is also effective in treating chronic pain conditions such as migraine (Anderson *et al*., 1975; Ter Kuile *et al*., 1994, 1995, 1996; Emerson and Trexler, 1999; Spinhoven, 2000), irritable bowel syndrome (Galovski and Blanchard, 1998), tumours (Spiegel and Bloom, 1983; Syrjala *et al*., 1992; Liossi and Hatira, 1999), rheumatoid arthritis pain (Geissner *et al*., 1994; Horton and Mitzdorf, 1994), back pain (Burte *et al*., 1994), fibromyalgia (Haanen *et al*., 1991) and coronary disorder (Weinstein and Au, 1991). However, hypnosis has not yet proven to be more effective than other psychological techniques. Two recent meta-analyses do not show significant differences between *suggested analgesia* and alternative *non-hypnotic psychological pain management strategies* such as relaxation, task motivational instructions, CBT, autogenic training and meditation (Chaves and Dworkin, 1997; Montgomery *et al*., 2000), even if some clinical studies indicate hypnosis could be more effective than relaxation for acute pain such as burn (Patterson and Ptacek, 1997) and for severe chronic pain such as rheumatoid arthritis (Horton and Mitzdorf, 1994; Geissner *et al*., 1994) and fibromyalgia (Haanen *et al*., 1991). The difficulty in differentiating the effectiveness of suggested analgesia from other non-hypnotic treatments might be explained by the fact that most techniques (hypnosis, guided imagery, autogenic training, meditation) have relaxation components. Thus, the question arises whether all effective techniques are just variations of relaxation or whether some possess a specific active ingredient other than relaxation. Techniques might differ in terms of names and theoretical backgrounds but may be actually very similar in terms of practice. That is the case, for instance, for hypnosis and guided imagery. The distinction between the two was originally made as a consequence of debates on the role attributed to mental imagery in the hypnotic process (e.g. Spanos and Barber, 1972; Barber, 1972; Wilson and Barber, 1982). Further, the effectiveness for OA pain relief of relaxation itself has not been separately evaluated in available studies (Calfas *et al*., 1994; Keefe *et al*., 1990a,b; Barlow *et al*., 1997, 1998, 1999), as it was included in global programmes aiming at relieving pain. This state of affairs urgently calls for controlled trials determining the degree of specificity of the different psychological techniques described.

Another important factor in establishing the efficacy of a clinical intervention is to determine whether there are individual differences in responding to the intervention. This question seems particularly relevant for relaxation and hypnosis as large individual differences exist in imagery skills (Denis, 1991; Lang, 1979, 1980; McKelvie, 1995) and as research on hypnotic susceptibility—a stable individual difference—has shown that hypnotic response is correlated with imagery factors (for a review, see Nadon *et al*., 1987). Interestingly, while it has been clearly demonstrated that relaxation does not enhance the hypnotic response (Hilgard, 1965; Council, 1999), Delmonte (1981) has shown that hypnotic susceptibility can be activated in people undergoing meditation or relaxation; in such a state, they are able to respond to hypnotic suggestions.

The first aim of the present study is to investigate whether a controlled hypnosis treatment is effective in relieving OA pain. In addition, the study was designed to clarify the impact on therapeutic response of relaxation and imagery processes active in hypnosis. Indeed, we hypothesize that relaxation, mainly used as a hypnotic induction procedure in clinical settings, plays a role in the therapeutic response. To this end, three experimental groups have been created: a waiting-list control condition, a relaxation condition in which participants followed a standardized eight-session relaxation treatment and a hypnosis condition in which participants followed a standardized eight-session hypnosis treatment. This design allows for the separation of the effects that are specific to relaxation and of those that are specific to hypnosis.

The present study also addresses whether hypnosis effectiveness is modified by individual differences in hypnotic susceptibility and mental imagery. To assess individual differences in imagery and hypnotic skills, we used two tests, one assessing the ability to respond to hypnotic suggestions, the other measuring two components of mental imagery.

METHOD

Participants

Thirty-six adults with knee OA (gonarthritis) and/or hip OA (coxarthritis) volunteered to participate in the study. Of these, 27 were recruited from classes for senior citizens provided by the University of Louvain-la-Neuve, Belgium, five were recruited through regional senior citizen associations and four were referred from physiotherapists. Characteristics of the sample are given in Table 1.

Prerecruitment questionnaires were distributed to potential participants. They included questions on symptomatology (diagnosis, pain location, duration and intensity, presence of other rheumatoidal diseases as well as lumbago and sciatica), medication and physiotherapy treatment. The inclusion criterion was a diagnosis of osteoarthritis no less than 6 months old, ascertained by a general practitioner or rheumatism specialist, on the basis of X-rays and/or a clinical examination. The patients had at least moderate levels of knee and/or hip OA pain (score equal to or above 2.5 on a 10-point scale assessing the average pain over the last month). Exclusion criteria were (a) a prosthesis on the target joint, (b) other rheumatoidal disorders (septic arthritis, polyarthritis, inflammatory joint disease, gout, recurrent episodes of pseudogout, Paget's disease, articular fractures, ochronosis, acromegaly, haemochromatosis, Wilson's disease and primary osteochondromatosis, sciatica and lumbago), (c) major medical problems requiring ongoing treatment, (d) psychological, neurological or central nervous system disorders that would bias the understanding of the instructions and (e) changes in the treatment (medication, physiotherapy) in the 3 months prior to the sessions.

On the basis of these criteria, 69 people were selected for the first interview. Of these 69 people, eight never came and 12 did not meet the selection

TABLE 1. Characteristics of the samples.

	Group			
	Total	Hypnosis	Relaxation	Control
Number of participants	36	13	13	10
Women	33	13	11	9
Men	3	0	2	1
Mean age (years)	64.7 (5.5)	64.15 (5.80)	63.92 (6.10)	66.30 (4.62)
Mean number of OA pain locations	5.00 (2.43)	5.69 (2.72)	4.92 (2.47)	4.10 (1.85)
Pathological duration of OA (years)	13.71 (10.87)	10.69 (8.75)	12.43 (9.29)	19.30 (13.86)
Number of participants with OA pain in the hip	24	8	8	8
Number of participants with OA pain in the knee	25	9	9	7
Number of participants with pain medication	14	5	4	5
Mean pain intensity (VAS)	4.18 (1.19)	4.16 (1.92)	3.68 (1.58)	4.40 (1.60)
Mean belief in treatment efficacy	1.15 (0.46)	1.00 (0.41)	1.31 (0.48)	NA
Mean hypnotic susceptibility (SHSS:C)	5.42 (2.74)	6.15 (3.16)	4.54 (2.73)	5.60 (2.01)
Anxiety (STAI B)	46.44 (8.96)	48.90 (7.63)	47.38 (9.47)	42.00 (9.12)
Depression (Zung)	40.39 (7.49)	40.92 (8.16)	41.08 (7.44)	38.80 (7.19)
Imagery	3.14 (0.56)	3.08 (0.57)	3.12 (0.68)	3.25 (0.35)

VAS, visual analogue scale.
[a]No differences on any variable describing participants' characteristics were observed between the three experimental groups, according to ANOVAs for parametric measures and Mann–Whitney's test for non-parametric measures.

criteria. Among the 49 who came to the first interview, eight stopped their participation immediately after the interview.

The 41 remaining participants were matched for OA location and age and then randomly distributed among the three conditions ($n = 14$ for the hypnosis condition, $n = 14$ for the relaxation condition and $n = 13$ for the control condition). Five participants dropped out of the sample before the first evaluation: three from the control condition, one from the relaxation condition and one from the hypnosis condition. In the control condition, one went for a thermal cure, one had a hip fracture and one received an infiltration. In the relaxation condition, one was excluded after revealing he had Paget's disease and, in the hypnosis condition, one had a hip fracture. All analyses were computed using data from the remaining 36 participants ($n = 13$ for the hypnosis condition, $n = 13$ for the relaxation condition and $n = 10$ for the control condition), of whom 33 were women. One participant from the control condition was absent at the 3 month follow-up session, and four could not come at the 6 month follow-up session (two from the hypnosis condition and two from the relaxation condition). Hence, there were 35 participants at the 3 month follow-up session and 32 at the 6 month follow-up session.

The participants were told that they would be participating in a research project investigating the effectiveness of two psychological interventions for OA pain, imagery and relaxation. Hypnosis was labeled 'imagery' to prevent for a selection bias, as some people could have been attracted to or frightened by supposed mystical aspects of the technique. Further, people are less likely to state that they would try hypnosis, even when descriptions of the proposed techniques are identical (Hendler and Redd, 1986). In addition, Sarbin and Coe (1972) and Barber (1972) have found that psychosociological factors, such as expectations and beliefs in the technique, are able to influence a person's response to suggestions.

Participants gave their informed consent as to the research duration (8 months) and the necessity of maintaining their treatment (medication, physiotherapy) during the experiment. People were also informed that they would be randomly assigned to a condition and that the control group would not receive any psychological treatment. As a compensation, we offered control participants the opportunity to be treated afterward with the technique that would prove to be most effective at the end of the present investigation. Participants were also informed that they would be fully debriefed at the end of the follow-up period. The protocol received IRB approval from the departmental ethical board.

Procedure

Overview of the study procedure

Before the treatment period started, all participants completed a questionnaire assessing various dimensions of OA pain. Health status and imagery were then assessed in a 2 h pretreatment session. Participants were assigned to one of the three experimental groups with the restriction that each group comprised the same number of participants with knee OA, hip OA or both knee and hip OA. There was no significant difference between groups in either cognitive status or average pain level. The participants of the hypnosis and relaxation conditions were asked about their *a priori* belief in the treatment efficacy before the first therapeutic session on a three-point scale (1 = 'I do not believe in the treatment you propose'; 2 = 'I do not know'; 3 = 'I do believe in the treatment'). They then took part in eight weekly individual sessions of 30 min each in a clinical interview room of the psychology department. (The treatment procedure is described below.) We did not give any instructions concerning home exercises. Indeed, the first aim of the present study was to investigate whether a *controlled standardized* hypnosis treatment is effective in relieving OA pain and was designed to clarify the implication of relaxation on therapeutic response.

Pain was assessed a second time halfway through the treatment (4 weeks after treatment begin), a third time 1 week after the treatment was discontinued (after 8 weeks), and at the 3 and 6 month follow-ups. During this last session, participants were thanked and fully debriefed. Participants of the control condition were treated with the technique found to be most effective in the experiments.

Experimenter assignment to treatment conditions

The experimenters were a postdoctoral clinical psychologist (first author) and four advanced psychology students who had undergone training in the laboratory for several months. These students followed treatment guidelines specifying the content of each intervention session and were asked to be friendly to the participants but to refuse counselling them for personal problems if they were requested to. During the sessions, each patient was received by three experimenters irrespective of his/her condition, hypnosis or relaxation, in a controlled counterbalanced procedure. Specifically, participant 1 was treated by experimenter 1 (licensed clinical psychologist) for three consecutive sessions, then by experimenter 2 (advanced psychology student) for the next three sessions and finally by experimenter 3 (advanced psychology student) for the last two sessions. Participant 2 was treated by experimenter 2 for three consecutive sessions, then by experimenter 3 for the next three sessions and finally by experimenter 1 for the last two sessions, etc.

This procedure differs from usual clinical practice but was selected for methodological and practical reasons: (a) this procedure minimizes systematic biasing effects from the experimenter, (b) participants were mostly treated by the advanced psychology students who were not aware of the hypotheses and (c) as the time spent with each patient was very important, it was impossible for one therapist alone to receive them all, and the work load needed to be split.

Treatment procedures

Hypnosis condition. The procedure is based on Erikson's technique. Hypnosis restricts the individual's perceptions of the external world by focusing his or her attention on specific internal stimuli, such as breathing. This attentional focus results in feelings of being removed from the environment and activates specific cognitive processes involving mental imagery. Participants were asked to sit in an armchair, close their eyes, and tell the experimenter about a pleasant vacation memory. The procedure started with a standardized relaxation induction. The reasons for the choice of relaxation induction are the following. Because we changed the label 'hypnosis' to 'mental imagery', a direct induction (e.g. using a pendulum) was not indicated. Moreover, such direct inductions are able to generate resistance in patients. We could not use exclusively concentration on breathing as an induction procedure, as it leads to relaxation and would have created a bias in testing the implication of relaxation in the therapeutic response.

Participants were asked to relax their muscles one by one (feet, calves, thighs, hands, forearms, arms, shoulders, back, chest, neck, eyebrows, eyes, jaw) and to be aware of proprio- and interoceptive sensations. This procedure lasted about 10 min. Then, participants were asked to imagine the pleasant holiday memory for about 5 min longer. While participants were supposed to be involved in their imagery activity, they were encouraged during the 15 following minutes to remember another positive memory from their childhood involving joint mobility. The type of memory was specified for each session and involved walks, open-air games and learning to ride the bicycle. This age regression (positive memory from their childhood) was encouraged but not forced, as not everybody is able to experience it. For each session and type of memory, the experimenter read a standardized script that evoked general images of movement and posture adaptation. These images were connected to indirect suggestions of postural adaptation. At the end of the session, participants were instructed to let the memories go like a pleasant dream and to come back to present. Each session lasted about 30 min.

The procedure never directly referred to pain and disability and offered no direct suggestions for analgesia (e.g. numbness, change in sensations) or posthypnotic suggestions to anchor the suggestions, as are often used (Syrjala and Abrams, 1999). The reasons for the choice of an indirect procedure using neither direct nor posthypnotic suggestions are related (1) to the title 'mental imagery', which did not lead one to suppose the use of suggestions, and (2) to the fact that we wanted the participants to mobilize personal resources, which is considered by Erickson to be the basis of therapeutic success, especially of

long-term response (Erickson and Rossi, 1981). Thus, the activation of personal knowledge and of procedural memory in the participants should lead to a better response to the therapy. Moreover, an approach based on age regression seemed to be of particular interest since our elderly population is used to reliving memories of the past and is likely to be more involved in the training when having the opportunity to enjoy old, pleasant memories.

Relaxation condition. People were asked to make small motions with their eyes closed, according to a standardized Jacobson's relaxation technique, often used in relaxation protocols (Arena and Blanchard, 1999). During the first four sessions, they had to tense and relax their muscles one by one (feet, calves, thighs, hands, forearms, arms, shoulders, back, chest, neck, eyebrows, eyes, jaw) and to be aware of proprio- and interoceptive sensations. After the fourth session, muscular grouping was operated; that is, they had to tense and relax both legs together, both arms, the trunk and the face. After relaxation, the experimenter counted from 1 to 3, and asked participants to open their eyes and to come back to the present. Each session lasted about 30 min.

Control condition. These participants did not receive any treatment and only came to the evaluation sessions. They were told that they would receive a treatment after the 6 month follow-up.

Measures

Pain ratings were assessed on a VAS ranging from 0 ('no pain') to 10 ('unbearable pain') with separate items for knee and hip, since VAS for pain has established reliability and validity (Huskisson, 1983). Pain level was recorded for three different periods: present pain, pain felt the week prior to assessment and pain felt the month prior to assessment.

Medication was reported at each assessment (type and dosage).

Hypnotic susceptibility was assessed with the Stanford Hypnotic Susceptibility Scale, form C (SHSS:C) (Weitzenhoffer and Hilgard, 1962; French version from Baroussa and Leclerc, 1991). This 12-item scale assesses motor responses to suggestions. It comprises three factors: (1) ideomotor inhibition (negative visual hallucination, arm rigidity, arm immobilization, anosmia), (2) difficulty factor (hand lowering, moving hands apart, dream, age regression) and (3) positive hallucinations (hallucinated voice, mosquito hallucination, taste hallucination). It is based on relaxation induction and contains inhibitory suggestions (e.g. eyes closing, arm rigidity) and cognitive suggestions (e.g. visual hallucination, amnesia).

Imagery vividness was measured in a procedure lasting about 20 min and similar to the hypnotic session with the exception that no movement or postural adaptation was suggested. Immediately after opening their eyes, participants answered questions assessing imagery vividness. These questions are directly derived from Sheehan's Questionnaire of Mental Imagery: 0, no image; 1, not vivid; 2, moderately vivid; 3, vivid; 4, as vivid as reality.

Measures of anxiety and depression were taken, using the STAI (Spielberger, 1983) and the Zung (1965) inventories.

The timing of the measures can be summarized as follows. During the first assessment session before treatment, participants had to answer questions about medication, pain level (VAS) and SHSS:C. During the second assessment session before treatment, they had to answer questions concerning Stai and Zung and vividness of imagery. Vividness of imagery and SHSS:C were assessed at the end of each session because these measurement procedures might induce a kind of somnolence and may thus influence the response to other assessments.

RESULTS

The present study investigated (a) the efficacy of hypnosis in reducing OA pain and (b) the individual variables (hypnotic susceptibility, imagery) that can mediate the potential effect of the experimental manipulation. All analyses were computed using the statistical software SPSS 6.1.1 for Macintosh.

Dependent measures

To measure the OA pain felt by the participants, a hip and knee pain score was computed by averaging the hip and knee pain VAS scales indexing actual pain, pain felt during the last week and pain felt during the last month. The internal reliability for this scale was found to be high at the different times of measurement (Cronbach's $\alpha = 0.84$, 0.89, 0.87, 0.93 and 0.90 respectively at the beginning of treatment, 4 weeks after treatment onset, 8 weeks after treatment onset, at the 3 month follow-up and at the 6 month follow-up). To index changes in pain over time and treatment conditions, pain difference scores were computed by subtracting the pain score before treatment from the pain score after each measurement.

Treatment efficacy

To test for treatment efficacy, a 3×5 MANOVA has been performed on the hip and knee pain score, with treatment group (control, relaxation, hypnosis) as a between-subjects factor and measurement time (4 weeks after treatment onset, 8 weeks after treatment onset, at 3 month follow-up and at 6 month follow-up) as a within-subjects factor. The treatment group effect was significant, $F(2,28) = 6.13$, $p < 0.007$, $\chi^2 = 0.30$, as well as the measurement time, $F(4,112) = 4.71$, $p < 0.003$, $\chi^2 = 0.14$. Contrasts were then performed to compare treatment groups two by two. The analyses first revealed that overall hypnosis and relaxation did not differ from each other, $F(1,20) = 1.55$, *NS*. The control group, however, was found to differ significantly both from the relaxation group, $F(1,18) = 4.75$, $p < 0.05$ and from the hypnosis group, $F(1,18) = 12.79$, $p < 0.003$.

Although no differences were found overall between the relaxation and the hypnosis conditions, the treatment group $\times$ measurement time interaction was significant, $F(8,112) = 2.25$, $p < 0.03$, $\chi^2 = 0.14$, suggesting that differences between treatment groups varied with time. One-way ANOVAs were thus performed at each time of measurement to examine these variations. As the three groups were not identical for their level of subjective pain when starting the procedure, ANCOVAs with subjective pain at time 1 as a covariate were performed. These analyses did not change the results and therefore are not reported. As expected, no differences were found at the first measurement time before the treatment was initiated, $F(2,33) = 0.55$, *NS*. Four weeks after the treatment has started, a main effect of treatment group was observed, $F(2,33) = 10.47$, $p < 0.0004$. *Post hoc* analyses using Bonferroni tests revealed that the hypnosis group differed from both the relaxation and the control group, while the relaxation and the control groups did not differ from each other (see Table 2). The measure taken 8 weeks after treatment onset also revealed a main effect of treatment group, $F(2,33) = 7.46$, $p < 0.003$. *Post hoc* analyses indicated again a significant difference between the hypnosis and the control group. This time, however, the hypnosis and the relaxation groups were not significantly different. Finally, the relaxation and the control groups differed significantly. At the 3 month follow-up, the main effect of treatment group, $F(2,32) = 7.00$, $p < 0.004$ was only explained by a difference between the hypnosis and the control group. Finally, at the 6 month follow-up, the effect of treatment was no more significant, $F(2,29) = 2.25$, *NS*.

Figure 1 and Table 3 also illustrate the pattern of change by using differences in subjective pain expressed as percentages.

TABLE 2. Pain intensity raw scores on VAS (from 0 to 10) at baseline, during treatment, and at follow-up as a function of group and measurement time.

Measurement time	Group		
	Hypnosis	Relaxation	Control
Before treatment	4.16[a] (1.92)	3.68[a] (1.58)	4.40[a] (1.60)
After 4 weeks	1.97[a] (1.31)	3.76[b] (1.77)	5.05[b] (1.79)
After 8 weeks	1.85[a] (1.65)	2.37[a] (1.62)	4.23[b] (1.14)
At 3 month follow-up	1.66[a] (1.49)	2.75[a,b] (1.91)	4.29[b] (1.31)
At 6 month follow-up	2.38[a] (2.47)	2.80[a] (1.63)	4.31[a] (2.38)

[a,b]Superscripts refer to the results of *post hoc* Bonferroni tests (between columns). Means not sharing a common superscript differ significantly ($p < 0.05$).

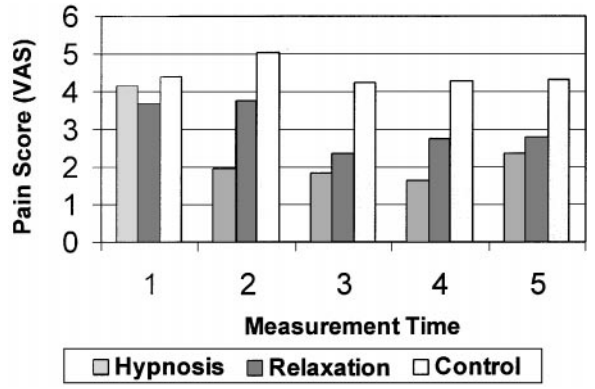

FIG. 1. Pain score according to measurement time and experimental group.

TABLE 3. Percentage of pain intensity change from baseline as a function of group and measurement time.

Measurement time	Group		
	Hypnosis	Relaxation	Control
After 4 weeks	−52	+2	+15
After 8 weeks	−56	−31	−4
At 3 month follow-up	−60	−22	−2
At 6 month follow-up	−51	−23	−2

Moderating effect of imagery and hypnotic susceptibility

The procedure proposed by Baron and Kenny (1986) has been used to examine whether imagery is a moderator of the treatment effects observed in the preceding analyses. These authors suggest regressing the interaction term between the independent variable and the moderating variable on the dependent variable. In addition to this procedure, we have also regressed, after entering the interaction term, the independent variable on the dependent variable. This procedure allows a comparison of the magnitude of the treatment effect (independent variable) with that of the moderator effect (imagery) on reported pain. Hence, multiple regressions were computed on the pain difference scores, with treatment effect and the treatment × imagery interaction as predictors. The results of these analyses, displayed in Table 4, clearly show that while both predictors were generally significant at all measurement times, the weight of the predictors changed over time. Treatment was the strongest predictor until the 3 month follow-up, whereas the treatment × imagery interaction became the most important predictor at the 6 month follow-up. This pattern suggests that imagery became a significant moderator only at the long-term follow-up.

The same procedure was used to test the possible moderating effect of hypnotic

TABLE 4. Test of the moderating effect of imagery: regressions of treatment and of treatment by imagery interaction on pain difference scores.

Measurement time	Effect	β	Proportion of explained variance (%)	*p*
After 4 weeks of treatment	Moderator[a]	0.24	6.6	0.05
	Treatment	0.53	25.9	0.001
After 8 weeks of treatment	Moderator[a]	0.35	10.5	0.02
	Treatment	0.44	17.4	0.01
At 3 month follow-up	Moderator[a]	0.25	4.1	0.11
	Treatment	0.46	18.4	0.01
At 6 month follow-up	Moderator[a]	0.55	29.1	0.001
	Treatment	0.32	7.5	0.07

[a]The moderator variable has been computed by multiplying standardized scores of imagery and treatment.

TABLE 5. Test of the moderating effect of hypnotic susceptibility: regressions of treatment and of treatment by hypnotic susceptibility interaction on pain difference scores.

Measurement time	Effect	β	Proportion of explained variance (%)	*p*
After 4 weeks of treatment	Moderator[a]	0.40	13.7	0.02
	Treatment	0.43	14.8	0.007
After 8 weeks of treatment	Moderator[a]	0.30	6.5	0.07
	Treatment	0.40	12.6	0.02
At 3 month follow-up	Moderator[a]	0.21	1.7	*NS*
	Treatment	0.43	16.1	0.01
At 6 month follow-up	Moderator[a]	0.37	10.9	0.04
	Treatment	0.29	5.9	0.09

[a]The moderator variable has been computed by multiplying standardized scores of hypnotic susceptibility and treatment.

susceptibility. As shown in Table 5, the results followed the same pattern, although the effects were less pronounced.

To explore further the impact of individual differences on pain reports, correlations between pain difference scores on the one hand and imagery and hypnotic susceptibility on the other hand have been computed for each experimental condition. The results of the analyses for imagery are displayed in Table 6. Although the sample size was very low, the pattern of correlation suggests that imagery acts as a moderator in the hypnosis and relaxation conditions. In the control condition, however, no relationships were observed, which was expected as no treatment was provided in that condition. The same pattern of correlations was found for hypnotic susceptibility but the magnitude of the correlations was lower (Table 7).

Effect of psychological treatment on medication use

To assess whether hypnosis and relaxation training diminish the use of pain medication, statistics were computed for all experimental conditions at each measurement time. As can be seen in Table 8, the number of participants taking medications remained equal over time in the control condition but decreased over time in the relaxation and the hypnosis conditions.

Mediating effect of belief in efficacy of the treatment

Correlations were computed between all pain difference scores and belief in treatment efficacy. No correlations were significant, suggesting that the effects of the treatment on pain difference

TABLE 6. Within-condition correlations between the pain difference score and imagery.

Measurement time	Hypnosis	Relaxation	Control
Before treatment	0.47 (13) *NS*	0.42 (13) *NS*	−0.21 (10) *NS*
After 4 weeks of treatment	−0.43 (13) *NS*	−0.70 (13) $p=0.008$	0.11 (10) *NS*
After 8 weeks of treatment	−0.54 (13) $p=0.056$	−0.27 (13) *NS*	0.06 (10) *NS*
At the 3 month follow-up	−0.45 (13) *NS*	−0.06 (13) *NS*	0.05 (9) *NS*
At the 6 month follow-up	−0.74 (11) $p=0.009$	−0.47 (11) *NS*	0.21 (10) *NS*

TABLE 7. Within-condition correlations between the pain difference score and hypnotic susceptibility.

Measurement time	Hypnosis	Relaxation	Control
After 4 weeks of treatment	− 0.48 (13) $p=0.05$	− 0.64 (13) $p=0.02$	− 0.05 (10) NS
After 8 weeks of treatment	− 0.24 (13) NS	− 0.66 (13) $p=0.02$	− 0.05 (10) NS
At the 3 month follow-up	− 0.27 (13) NS	− 0.14 (13) NS	− 0.07 (9) NS
At the 6 month follow-up	− 0.47 (11) NS	− 0.29 (11) NS	− 0.10 (10) NS

TABLE 8. Number of participants using pain medication according to measurement time and group.

Measurement time	Hypnosis	Relaxation	Control	_2	*p*
At the beginning of the treatment	5 ($n=13$)	4 ($n=13$)	5 ($n=10$)	0.24	0.62
After 4 weeks of treatment	2 ($n=13$)	3 ($n=13$)	5 ($n=10$)	3.13	0.07
After 8 weeks of treatment	1 ($n=13$)	2 ($n=13$)	5 ($n=10$)	5.38	0.02
At the 3 month follow-up	1 ($n=13$)	2 ($n=13$)	5 ($n=9$)	6.17	0.01
At the 6 month follow-up	1 ($n=11$)	2 ($n=11$)	5 ($n=10$)	4.45	0.03

scores cannot be accounted for by participants' belief in the efficacy of the treatment.

DISCUSSION

Summary and general implications

The first aim of the study was to assess the efficacy of relaxation and hypnosis training for the treatment of OA pain. The present data show that hypnosis is effective as it reduced more than 50% of OA pain after only 4 weeks of training. This reduction was maintained up to the 6 month follow-up and was significantly different from the control condition until the 3 month follow-up. Relaxation also resulted in lower level of subjective pain, but only at the end of the 8 weeks treatment. In other words, hypnosis was more efficient than both the relaxation and the control conditions 4 weeks after the beginning of the treatment. At 8 weeks, the two experimental groups had lower subjective pain than the control group. At the 3 month follow-up, relaxation did not differ from the two other groups but hypnosis was still significantly more efficient than the control and at the 6 month follow-up the effects of the treatment provided in the two experimental groups were no more significant. As regards medication use, both hypnosis and relaxation seem to be effective in reducing the amount of pain medication taken, at least after the 8 weeks of treatment. These therapeutic effects cannot be attributed to anxiety or depression since our sample was neither anxious nor depressive.

In sum, the present data suggest that hypnosis is effective in significantly reducing perceived OA pain and medication use; relaxation seems to be less rapidly effective, at least regarding reported pain. This difference between the hypnosis and relaxation conditions suggests that the active component of the hypnosis treatment cannot be reduced to a placebo effect or to a mere effect of muscle relaxation.

No differences were observed in participants' belief in treatment efficacy in the two experimental groups, and no correlations were observed between pain difference scores and beliefs in efficacy. Thus, the treatment benefits observed cannot be explained by participants' beliefs in the efficacy of the treatment procedure used. These results also militate against a placebo effect.

At the theoretical level, this pattern of results is incongruent with the psychosocial theory of hypnosis (e.g. Barber, 1972; Sarbin and Coe, 1972; Spanos *et al*., 1987, 1991), which asserts that attitudes toward hypnosis, and in particular belief in its efficacy, are the main determinants of its effects. Further evidence against the main role of beliefs and attitude played in the hypnotic response is that using the label 'imagery' instead of 'hypnosis' did not seem to have diminished the effects of the hypnosis condition.

The second aim of this study was to investigate whether imagery and hypnotic susceptibility could moderate treatment effects. The present results show that imagery and hypnotic susceptibility have a moderating effect in both the hypnosis and the relaxation conditions. The results indicate, however, that these two factors explain only the maintenance of the positive effects of hypnosis and relaxation at the 6 month follow-up. This suggests that these two dimensions are particularly important for the long-term maintenance of treatment benefits.

Imagery and hypnotic susceptibilities are not the only explanatory factors of the effects during treatment and at the 3 month follow-up as the type of treatment was also a predictor for pain differences. The most likely candidate to explain the results during the first part of the treatment (i.e. after 4 weeks) may be the imagery processes specific to Erikson's hypnotic condition. The only variable to be manipulated in the hypnotic condition was the elicitation of mental imagery. Hypnotic instructions were designed to enhance the vividness of the mental images and to propose concrete solutions regarding postural adaptation. The relaxation condition did not involve any mental activation. The elicitation of imagery factors also leads to better therapeutic results whether or not people have imagery or hypnotic abilities. However, even if the kind of technique used has different effects on subjective pain, imagery abilities help patients to obtain greater pain reduction, even in the relaxation condition. The data we have obtained thus far suggest that imagery has been spontaneously activated during

the relaxation procedure (cf. Tables 5 and 6). This is in agreement with the results of several studies (Benson, 1983; Zahourek, 1988; Kokoszka, 1992) showing that, during standard relaxation procedures, the mental state of the subject was altered and mental imagery was spontaneously activated.

Our results are congruent with the role attributed to mental imagery by cognitive theorists (Lang, 1979; Paivio, 1971; Kirby and Kosslyn, 1992). Mental imagery plays a central role in the activation and processing of information, especially perceptual information (Denis, 1991; Kunzendorf, 1991). It also has the capacity to elicit and to modulate somatic responses (Lang, 1979, 1980). In this line, mental imagery could act through different processes to alleviate pain. One possibility is that the active component of the treatment procedures used in the present study is the elicitation of more functional and adaptive visceral responses during mental imagery. Three pathways can be suggested here: (a) mental imagery can be used to elicit visceral responses that are incompatible with those leading to or maintaining pain; (b) because of its capacity to modulate visceral responses, mental imagery could diminish the severity of those visceral responses leading to pain; (c) mental imagery can act as a distracter to shift attention away from pain stimuli.

On a clinical level, patients can benefit from a hypnotic treatment for reducing OA pain even if they do not show specific imagery abilities. Imagery is elicited when encouraged by the therapist even when patients do not have any imagery ability, but patients with imagery skills will be able to benefit more from the procedure in the long run. Thus, imagery might be taken into account when screening patients to determine who will benefit most from hypnosis and relaxation treatment, especially as regards the maintenance over time of treatment benefits. It may also lead to different treatment proposals according to imagery skills, as therapeutic results in people with poor imagery skills may call for more regular training in the long run.

It is important to point out that individual hypnosis training is very effective in the treatment of OA pain. Moreover, this kind of training, which is passive, is not very demanding for patients and does not involve conscious coping mechanisms acting against pain. Hypnosis can thus be used very easily in care settings for old and very old patients suffering from joint disorders.

In the present study, treatment was conducted in individual sessions while, in other studies, group sessions are often used, for practical reason. The superiority of hypnosis evidenced in the present study is perhaps due to these individual sessions, as people might need more personal attention to involve themselves in personal memories, as was required by the hypnotic procedure. However, the use of multiple experimenters for each participant demonstrates that it is not necessary to have a formal therapeutic alliance to obtain results.

Overall, the hypnosis and the relaxation conditions did not differ from each other. After 4 weeks of treatment, however, the decrease from the baseline level was very important only in the hypnosis condition, participants in the relaxation condition staying at the same level of subjective pain. At that time, the two groups differed significantly from each other. At 8 weeks, the difference between the hypnosis and the relaxation groups was not more significant. These results suggest that hypnosis can be preferred over relaxation in the case of severe subjective pain, which needs to be alleviated rapidly. When pain severely interferes with cognitive and physical activities, people will probably tend to prefer an intervention that already evidences significant effects after 4 weeks than waiting 8 weeks before feeling less pain. At 3 months follow-up, however, there is no reason to favour one intervention over the other on the basis of the present study (and on previous ones generally showing no differences between relaxation and hypnosis).

Weaknesses

The present study suffers from a relatively limited number of participants, a common limitation in studies recruiting patients. This small n might have provided statistical effects, but one could then question the clinical significance of such effects. However, more participants might have helped to clarify the role of individual

differences, such as imagery and suggestibility in the therapeutic.

Another limitation is that we did not evaluate the belief in the efficacy of the therapists, a possible confounder of the effects observed. However, we believe that the way the students were instructed to conduct the sessions limits the bias—the scientific ideal would have been a double-blind procedure, but it is impossible in such therapeutic sessions, as one cannot ignore the therapy that one is administering.

Still another limitation is that we did not record whether participants spontaneously rehearsed the technique, whether relaxation or hypnosis, at home. Indeed, the decrease of therapeutic effect of hypnosis 6 months after the sessions might be due to the absence of instructions for home exercises. At a therapeutic level, it raises the question of whether it is better to give instructions for home exercises to patients at the beginning of the sessions or whether it is better to initiate one or several booster sessions around 6 months after the end of these sessions. This question is of interest for patients who are reluctant to make any personal investment between the sessions and/or for very old patients.

A final limitation of the present study is that we did not use identical relaxation procedures in both experimental conditions, as we used the Jacobson procedure in the relaxation condition and a variation of it in the hypnosis condition. Further, the relaxation procedure was shorter in the hypnotic condition. However, given the observed superiority of hypnosis vs relaxation alone, the latter characteristic tends to substantiate the impact of processes alien to relaxation in hypnosis.

Direction for future research

In the present study, mental imagery has been directly and voluntarily activated in the hypnosis procedure. Future studies might manipulate direct *vs* indirect analgesia suggestions in OA, since Matthews (2000) recently suggested that there would be no justification for the use of indirect suggestions in hypnosis. Future studies might directly manipulate the dimensions of vividness of imagery and postural changes in order to determine the impact of these factors on OA pain reduction. It is also important to determine the impact of home practice on subjective pain, depending on the psychological technique used in trials with homework *vs* no homework.

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