

ORIGINAL ARTICLE

Efficacy and cost-effectiveness: A study of different treatment approaches in a tertiary pain centre

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Abstract

Background: Chronic pain is considered to be a complex phenomenon, involving an interrelation of biological, psychosocial and sociocultural factors. Currently, no single treatment or therapy can address all aspects of this pathology. In our expert tertiary pain centre, we decide to assess the effectiveness of four treatments for chronic pain classically proposed in our daily clinical work: physiotherapy; psycho-education; physiotherapy combined with psycho-education; and self-hypnosis/self-care learning.

Methods: This study included 527 chronic pain patients, with a mean duration of pain of 10 years. Patients were allocated either to one of the four pre-cited treatment groups or to the control group. Pain intensity, quality of life, pain interference, anxiety and depression were assessed before and after treatment.

Results: This study revealed a significant positive effect on pain interference and anxiety in patients included in the physiotherapy combined with psycho-education group, after 20 sessions spread over 9 months of treatment. The most prominent results were obtained for patients allocated to the self-hypnosis/self-care group, although they received only six sessions over a 9-month period. These patients showed significant benefits in the areas of pain intensity, pain interference, anxiety, depression and quality of life.

Conclusions: This clinical report demonstrates the relevance of biopsychosocial approaches in the improvement of pain and psychological factors in chronic pain patients. The study further reveals the larger impact of self-hypnosis/self-care learning treatment, in addition to a cost-effectiveness benefit of this treatment comparative to other interventions.

1. Introduction

Several studies have showed that chronic pain can be defined as prolonged and persistent pain lasting at least 3 months beyond the expected healing period of tissue pathology (Turk et al., 2011). It is considered to be a complex phenomenon where biological,

psychosocial and sociocultural factors are strongly interrelated, and carries a 19% prevalence rate in Europe (Breivik et al., 2006). Chronic pain patients typically present multiple problems such as depression, anxiety and disability (Eccleston et al., 2013). This pathology is rarely a 'diagnosis' that clearly explains the cause of pathology. Currently, and despite research efforts, there is no curative treatment

What's already known about this topic?

- Biopsychosocial factors should be considered in the management of chronic pain.
- No single treatment or therapy can address all aspects of this pathology.

What does this study add?

- Comparison of four treatments: physiotherapy, psycho-education, physiotherapy combined with psycho-education and self-hypnosis/self-care learning.
- Study of the effectiveness of four treatments, as well as cost-effectiveness benefits.
- Greater effect of self-hypnosis/self-care treatment.

for chronic pain. Indeed, no single medication, procedure or therapy can address all aspects of this pathology. Despite that clinicians will continue to use pharmacological agents as chronic pain treatment, several studies have showed the benefits of non-pharmacological approaches that possess comparable effect: e.g. multidisciplinary cognitive behavioural programmes have been shown to improve a sense of coherence and depression, and to reduce anxiety (Kamper et al., 2014) and was considered as supporting efficacy in the management of chronic pain (Hassett and Williams, 2011). In addition, several studies have showed that physical exercises are considered to be an effective treatment for patients with chronic pain (e.g. in peripheral neuropathic pain, Toth et al., 2014). Hypnosis intervention, on the other hand, was demonstrated to be more effective than no-treatment in reducing pain in chronic pain patients (Elkins et al., 2007). Until now, few studies have directly compared outcomes of different treatment interventions in chronic pain patients (Jensen et al., 2009; Flik et al., 2011; Miyamoto et al., 2013; Toth et al., 2014). The aim of this clinical non-randomized prospective study was to assess the effectiveness of different treatments based on psychological and/or physiological approaches, such as physiotherapy, psycho-education, physiotherapy combined with psycho-education and self-hypnosis/self-care learning.

In 2005, the National Institute for Health and Disability Insurance of Belgium (NIHDI) concluded an agreement with multidisciplinary pain centres, permitting a predetermined number of chronic pain patients to receive a multidisciplinary pain diagnosis and an adapted treatment programme. The cost of clinical workup and treatments were directly reim-

bursed to the pain centres by the NIHDI. The agreement further stipulated that treatment sessions must (1) be carried out using a multidisciplinary approach and (2) consist of a maximum of 20 sessions during a predetermined period. In addition, patients were asked to complete questionnaires before and after treatment programmes; these questionnaires covered pain intensity, the impact of pain on quality of life, and the degree of pain interference with daily life functioning as well as degrees of anxiety and depression. The Algology and Palliative Care Department of the University Hospital of Liège, Belgium proposed four different therapeutic interventions: physiotherapy; psycho-education; physiotherapy combined with psycho-education; and self-hypnosis/self-care learning.

2. Methods

2.1. Population

Therapeutic interventions were proposed to patients with chronic pain in our Algology and Palliative Care Department. From January 2007 to December 2012, patients with a long history of chronic pain (including patients suffering pain despite an adapted pharmacological treatment) were included in the study.

2.2. Design

The study included four phases: (1) an initial screening phase during which the algologist elaborated an appropriate pain diagnosis and proposed the patient as suitable for a multidisciplinary approach, (2) a baseline pre-treatment assessment of patients' health using questionnaires, (3) a treatment delivery phase and (4) a post-treatment assessment of patients' health using the same questionnaires. Between phases 2 and 3, patients have to meet all experts of the pain team encompassing algologist, nurses, physiotherapist and psychologist. Once patients have met each expert, pain diagnosis was elaborated based on discussion during weekly multidisciplinary meeting. Based on our clinical experience and existing guidelines, pain diagnosis includes the research of chronic pain aetiology, specific pain symptoms and signs, as well as medical and psychiatric comorbidities. During the meeting, the multidisciplinary team allocated patients to a treatment group based on patients' physical and psychological conditions, patients' individual pain history, patients' daily functioning as well as previous treatments tested by the patients.

Patients were informed about all the possibilities. Preferences about the type of treatment approach were also discussed with the patients during the psychological evaluation by our pain psychologist. Patients' agreement with approaches proposed by the team as well as patients' agreement to actively participate were mandatory. Treatment was proposed according to our clinical experience, supported by previous results showing the interest of physiotherapy (Maquet et al., 2006, 2010), self-hypnosis (Palmaricciotti et al., 2010) and psycho-education (Laroche, 2013) in chronic pain management. For daily practice, it is of upmost value to evaluate the effectiveness of daily routine treatment, not just for the care providers themselves but also for patients and other caregivers. A pain diagnosis is announced and a treatment plan is proposed to the patient by the algologist.

In this study, we compared four treatment plans and a control group. These four treatment plans were chosen according to: (1) the expertise of each pain team member (our psychologists are specialized in cognitive behavioural therapy approaches, psycho-education and hypnosis; physiotherapists are specialized in physical reconditioning and back schools; and the algologist in hypnotic approaches), (2) previous preliminary results that showed the interest of these approaches in the chronic pain management (Maquet et al., 2006, 2010; Palmaricciotti et al., 2010; Laroche, 2013).

(1) *Control group* included patients who were not able to participate in any intervention group for various reasons such as long distance between home and the centre, travelling difficulty, lack of interest in regard of the treatments proposed and lack of French comprehension. Patients included in this group were invited to complete pre- and post-assessment health questionnaires after a waiting period of 9 months.

(2) *Physiotherapy* programme was conducted by rehabilitation specialist, physiotherapists and occupational therapist and combined 'back school' with physical training programmes. A complete description of physiotherapy programme can be read in (Demoulin et al., 2010). The 'back school' programme (eight sessions) consisted of theoretical information on spinal functional anatomy and pathophysiology, identification of risks associated with daily activities and description of preventive measures. A number of exercises were used to put this information into practice, targeting muscle awareness and proprioception, breathing and relaxation, handling of loads and adjustment of daily activities.

Emotions associated with pain, coping strategies and the impact of chronic pain on quality of life were also discussed. The physical training programme (12 sessions) included graded exercise therapy encompassing training on a cycle ergometer, muscle toning, stretching and individually tailored exercises. These exercises comprised active mobilization of the trunk muscles. Physiotherapy consisted of 120 min, sessions twice a week, over a period of 10 weeks.

(3) *Psycho-education*, also known as therapeutic patient education, was conducted by two psychologists, expert in pain management. Psycho-education is 'designed to train patients in the skills of self-managing or adapting treatment to their particular chronic disease, and in coping processes and skills' (World Health Organization Regional Office for Europe Copenhagen, 1998). This intervention involves supportive and non-directive group discussions. These discussions aim to empower patients to become active participants in their own treatment, and to provide patients with a comprehensible model of pain mechanisms, an understanding of the rationale for pharmacological, physical and psychological therapy, and an acceptable rationale for making life style changes. Each group included 8–10 patients. Patients received 8–10 weekly sessions, with each session lasting 2 h.

(4) *Psycho-education combined with physiotherapy*. Patients in this group simultaneously received 10–12 physiotherapy sessions of 120 min and 8–10 psycho-education sessions lasting 2 h.

(5) *Self-hypnosis/self-care learning* was conducted by a pain specialist. Teaching self-hypnosis and self-care effectively is primarily based on good communication between health care provider and patient, involving interventions tailored to the kind of problems that chronic pain patients often encounter. During years of consultation with chronic pain patients by the research team, a non-judgmental approach has been found to facilitate an open exploration of patients' beliefs and concerns. These patients often provide themselves with detrimental negative suggestions, express extreme fears about the future evolution of their chronic pain syndrome and consider their pain to be 'out of control'. Patients also typically exhibit low levels of self-esteem and self-confidence, are often dependent on the judgment and opinions of others, and have difficulty or feelings of guilt associated with saying 'no' to others' demands. In addition, these patients tend to be intensely preoccupied with pain and the consequences of pain, narrowing their range of experience. Based on these observations, and to overcome

these difficulties, we created a negotiating approach that fosters shared decision making through using tasks centred on general well-being rather than on the pain problem itself. Patients were asked to be actively involved and to give their consent in introducing changes to their usual daily functioning. Self-hypnosis/self-care learning was used as a process of activating patients by rejecting the passivity role often encountered in this patient group, to expand awareness and amplify positive experiences. The following topics were addressed through tasks: adjusting self-expectations; revision of self-narrative; reinforcing sense of self-worth; adaptation of social roles; identification of situations and feeling of powerlessness; finding one's own boundaries and personal needs; accepting that not everything is controllable; and differentiating self from illness. Patients were given homework assignments during the time between sessions and were encouraged to practise skills to consolidate learning. Patients were also required to keep a 'work-diary'; these diaries were reviewed at the beginning of each session. At the end of the session, a 15-min hypnosis exercise was conducted with the group of patients. They finally received individual CDs containing the hypnosis exercise from the session, and were invited to perform this exercise on a daily basis. Each group included 8–10 patients. Patients received six sessions of 2 h at 5 weeks intervals.

2.3. Data collection

The following measures were contained in the pre- and post-intervention assessment battery:

The Visual Analogue Scale (VAS) has been widely used to assess pain in former studies. The VAS score helps to determine the intensity of pain, as subjectively assessed by the patient, on a scale ranging from 0 to 10. In this study, patients were asked to assess the pain felt during the past 4 weeks.

The Pain Disability Index (PDI; Pollard, 1984) assesses the degree of pain interference with seven aspects of daily life functioning: family/home responsibilities; recreation; social activity; occupation; sexual behaviour; self-care; and life-support activity. Each item score can range from 0 (no interference) to 10 (total interference). Total score can therefore range from 0 to 70. A high total score indicates that the patient considered pain interfere in their daily life to be substantial.

The Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983) is composed of two subscales, each comprising seven items. Patients score items on a

4-point (0–3) response category, thereby resulting in scores ranging from 0 to 21 for either subscale. Scores of 0–7 are considered to be within the normal range; scores of 11 and higher indicate the probable presence of a mood disorder (i.e. 11–15: moderate cases; 16 or higher: severe cases); and scores of 8–10 are only suggestive of the presence of mood disturbance. Interestingly, the HADS minimizes the recording of somatic symptoms; therefore, allowing the measurement of anxiety and depression symptoms in patients with comorbid physical illnesses.

The Short Form Health Survey questionnaire (SF-36; Ware and Sherbourne, 1992) allows the assessment of general health in clinical practice and research, health policy evaluations and general population surveys. It provides scores with a maximum of 100 against eight dimensions of health. These eight dimensions are limitations in physical activities because of health problems; limitations in social activities because of physical or emotional problems; limitations in usual role activities because of physical health problems; bodily pain; general mental health (psychological distress and well-being); limitations in usual role activities because of emotional problems; vitality (energy and fatigue); and finally general health perceptions. These eight dimensions are summed up in two additional and distinct categories: the 'Physical Component Summary' (PCS) and the 'Mental Component Summary' (MCS). Higher scores on these scales indicate better mental and physical health. Norm-based scores are mean score = 50, standard deviation: 10.

2.4. Statistical analysis

The acquired results were processed using statistical data processing software Statistica 10 (StatSoft, Tulsa, OK, USA). Multivariate analyses (ANOVA) were calculated regarding duration, therapeutic group and gender. We used Tukey's test (HSD for unequal sample sizes) for the *post hoc* comparisons, with a *p*-value <0.05. The pre- and post-assessment comparison of each measure (HADS, PDI, SF-36, VAS) within each group was made using the Wilcoxon test for matched pairs. All statistical tests were two-tailed, and a *p*-value <0.05 was considered statistically significant.

3. Results

3.1. Baseline results

The multidisciplinary team allocated 527 patients with chronic pain [440 females (mean age

54 ± 11 years; mean duration of pain 116 ± 118 months), 87 males (53 ± 10 years; 104 ± 111 months)] to the NIHDI treatment programme. Of these 527 patients, 88 were assigned to the control group, 61 to physiotherapy group, 50 to psycho-education group, 169 to physiotherapy/psycho-education group and 158 to self-hypnosis/self-care group [different chronic pain aetiologies were equally represented across groups (Faymonville et al., 2014)]. Table 1 presents characteristics of patients for each treatment group. Mean duration between pre- and post-health assessment was 9 ± 3 months.

Table 2 presents mean scores of the different questionnaires on pre- and post-assessment according to the group assignment. Statistical analysis showed that the groups differed at the baseline (i.e. before treatment) ($F(65) = 4.73$; $p < 0.001$). These results mean that patient's health characteristics differed between groups, suggesting that the multidisciplinary team had taken into account the patients' characteristics in the treatment decision process.

3.2. Global effects

A multivariate analysis with repeated measures on time of evaluation (i.e. pre- and post-treatment) indicated a significant effect of time [$F(6) = 4.22$; $p < 0.001$] and group [$F(30) = 4.03$; $p < 0.001$]. *Post hoc* analysis revealed effect of time for VAS measures [$F(1) = 13.29$; $p < 0.001$], PDI [$F(1) = 8.25$; $p = 0.004$], HADS [$F(2) = 3.81$; $p = 0.02$] and SF-36

[$F(2) = 8.35$; $p < 0.001$]. Group effect was found for HADS measures [$F(10) = 9.87$; $p < 0.001$] as well as SF-36 [$F(10) = 2.25$; $p = 0.013$]. Effect of gender was found only for HADS measure [$F(2) = 3.47$; $p = 0.03$].

3.3. Pre- and post-treatment changes

The pre-treatment to post-treatment changes in HADS (anxiety and depression), SF-36 (MCS and PCS), PDI and VAS scores are shown in Table 2. Significant decrease in anxiety can be observed as the result of physiotherapy/psycho-education treatment ($p = 0.04$) as well as the result of self-hypnosis/self-care treatment ($p < 0.001$), while decrease in depression was observed only after self-hypnosis/self-care treatment ($p < 0.001$). Decrease in the mental component measured by the SF-36 between the pre- and post-assessment was observed for both psycho-education ($p < 0.001$) and self-hypnosis/self-care treatments ($p < 0.001$). The degree of pain interference measured by the PDI diminished between the pre- and post-assessment for both physiotherapy/psycho-education treatment ($p < 0.001$) and self-hypnosis/self-care treatment ($p < 0.001$). Diminution of pain intensity between pre- and post-assessment was observed only for self-hypnosis/self-care treatment ($p < 0.001$).

4. Discussion and conclusions

The aim of this study was to explore the effectiveness of pain interventions in reducing disability associated with chronic pain. We demonstrated that patients' demographic characteristics were homogeneous according to the treatment group, although health characteristics were different according to the group (suggesting that the assessment and prescription of interventions were based on the patients' characteristics). Despite these different profiles, our results showed a global trend of decrease in pain intensity, pain interference, anxiety and depression, and an increase in quality of life for all groups. No difference was found between pre- and post-assessment in the control group. These observations evidence that each treatment approach provided an improvement, in particular, in emotional functioning.

We showed a global effect from time elapsed between pre- and post-assessment on pain intensity, pain interference, anxiety, depression and quality of life; a group effect on depression, anxiety and quality of life, meaning that treatment interventions have

Table 1 Mean and standard deviation (SD) for age and pain duration of patients according to gender and therapeutic group.

Therapeutic group	Number of patients (N)	Gender repartition	Mean age, years (SD)	Mean duration of pain, months (SD)
Control	89	24 Male 65 Female	53 (13) 56 (13)	122 (150) 121 (133)
Physiotherapy	61	15 Male 46 Female	57 (7) 53 (10)	111 (106) 94 (92)
Psycho-education	50	4 Male 46 Female	53 (10) 53 (11)	26 (6) 73 (86)
Psycho-education and physiotherapy	169	19 Male 150 Female	55 (9) 54 (10)	72 (84) 114 (113)
Self-hypnosis/self-care learning	158	25 Male 133 Female	51 (10) 54 (11)	125 (89) 98 (130)
Total	527	87 Male 440 Female	53 (10) 54 (11)	104 (111) 116 (118)

Table 2 Mean scores and standard deviation for each measure in pre- and post-health assessment according to the treatment group.

	Control (SD)		Physiotherapy (SD)		Psycho-education (SD)		Psycho-education and physiotherapy (SD)		Self-hypnosis and self-care learning (SD)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
VAS	5.5 (1.6)	5.7 (2.3)	5.8 (1.7)	5.3 (2.2)	6.1 (1.8)	5.5 (2.3)	6.1 (1.7)	5.8 (2.2)	5.3 (1.8)	4.6* (2)
PDI	40.84 (15.3)	38.8 (16.8)	39.6 (13.2)	35.2 (16.2)	42 (14.5)	36.8 (17.5)	44.1 (12.4)	39.7* (14.2)	38.5 (12.7)	32.8* (14)
HADS										
Anxiety	11.4 (4.6)	11 (4.4)	12.7 (4.4)	11.4 (4.2)	12.6 (4.4)	11.5 (4.2)	12.4 (4.5)	11.5* (4.6)	9.4 (4.1)	7.8* (4.1)
Depression	9.2 (4.1)	8.8 (4.2)	9.5 (4.4)	8.9 (4.3)	11.4 (4.3)	9.8 (5)	9.9 (4.1)	9.9 (4.5)	11.9 (4.5)	10.2* (4.2)
SF-36										
PCS	29.3 (9.3)	30.8 (9.5)	31.2 (7.5)	33.4 (8.7)	30.5 (6.4)	31.9 (10)	30.1 (7.7)	31.5 (8.4)	33 (7.9)	34.5 (7.9)
MCS	27.1 (12.2)	28.4 (12.8)	27.6 (13.5)	30.6 (13.3)	22.5 (10.7)	28.9* (13.9)	25.9 (11.3)	28.4 (13.2)	27.9 (12.5)	33.2* (13)

*Comparison pre- versus post-assessment, $p < 0.05$; SD, standard deviation.

an influence on the assessment of these measures. We also observed a gender effect on anxiety and depression, highlighting that women were showing higher anxiety and depression levels according to the HADS. These observations support results on gender difference in depression and anxiety (Nolen-Hoeksema, 2001).

After receiving 20 sessions of 2 h of physiotherapy, patients showed no improvement between pre- and post-assessment, in contradiction to previous studies which have reported a diminution of pain intensity for patients with peripheral neuropathic pain after physiotherapy (Toth et al., 2014). These differing results can be explained by various exercises treatments used and by the number of sessions proposed. Our results supported the absence of improvements to anxiety, depression and quality of life reported in studies of chronic pain patients after physiotherapy (Toth et al., 2014).

We showed that 8–10 sessions of 2 h of psycho-education improve the mental component of the quality of life. These results were consistent with reported beneficial effect of psycho-education on emotional well-being for patients with early-stage breast cancer (Matsuda et al., 2014). We do not confirm observations highlighting the positive impact of psycho-education on pain intensity, depression and pain interference in chronic pain (Bennett et al., 2011; Toth et al., 2014), fibromyalgia (Luciano et al., 2013) and post-whiplash (Meeus et al., 2012). These differing results can be explained by methodological factors such as the duration of psycho-educational intervention, the material used to inform patients (verbal, written or audiovisual tools) as well as whether the intervention took place in a group or in an individual practice.

We showed that psycho-education had more impact on patient's health when it was combined

with physiotherapy. We found a decrease in pain interference in daily life, and an anxiety decrease, when patients received both psycho-education and physiotherapy. These results corroborate studies demonstrating a reduction in pain interference in chronic pain patients after psycho-education/physiotherapy (Comer et al., 2013; Miyamoto et al., 2013).

The most significant results were observed for patients allocated to the self-hypnosis/self-care group, although they received only six sessions of 2 h over a 9-month period. Our results showed that patients assigned to the self-hypnosis/self-care group demonstrated more benefits in a larger variety of biological, psychological and social dimensions implicated in chronic pain (pain intensity, pain interference, anxiety, depression and quality of life) as compared to other groups. A recent meta-analysis showed that hypnosis is more efficacious in chronic pain patients than other psychological interventions such as biofeedback, cognitive-behaviour therapy and muscle relaxation (Adachi et al., 2014).

We demonstrated that pain intensity decreased only in patients assigned to the self-hypnosis/self-care group. These results confirm studies highlighting the beneficial effect of hypnosis in reducing pain intensity in patients with multiple sclerosis (Dane, 1996; Jensen et al., 2005), tension-type headache (Spinhoven and ter Kuile, 2000), fibromyalgia (Castel et al., 2007) as well as a variety of other pain diagnoses (James et al., 1989; Lewis, 1992; Jensen et al., 2005). Our results correlate with observations showing greater decreases in pain perception in patients who received cognitive restructuring interventions in comparison with patients who received therapeutic education (Ehde and Jensen, 2004).

Currently available treatments for chronic pain rarely result in complete resolution of symptoms. There is a need to better understand the effect of

hypnosis on other domains related to chronic pain, such as daily life and psychological factors. Our study aimed to extend knowledge about psychological factors influenced by hypnotic treatment; we demonstrated that psychological factors such as anxiety and depression are decreased by self-hypnosis/self-care treatment. Some studies did not report a positive impact of hypnosis on depressive symptoms in chronic pain patients (Jensen et al., 2005). These differing results can be explained by methodological factors, such as the hypnotic suggestions used with patients. Studies on other populations, such as patients with haemodialysis, cancer in palliative care or Morgellons disease have reported that hypnosis has a positive effect on anxiety and depression (Gartner et al., 2011; Plaskota et al., 2012; Untas et al., 2013).

We have shown a decrease in pain interference in daily life for the self-hypnosis/self-care group. These results are consistent with studies showing decreases of pain interference in patients with chronic musculoskeletal pain (Tan et al., 2010; Roja et al., 2013). Catastrophizing involves a tendency to focus on pain and to evaluate its effects in unrealistic and overly negative terms (Jensen et al., 2011) and was associated with pain interference in chronic pain patients (Keefe et al., 2004). By increasing patients' sense of control over their pain, we can hypothesize that self-hypnosis/self-care may have an effect on catastrophizing.

By highlighting the quality of life improvement in the self-hypnosis/self-care group, our results support studies involving musculoskeletal disorders (Roja et al., 2013), irritable bowel syndrome (Bremner, 2013) and Parkinson disease (Elkins et al., 2013). Our results fit with a review showing the effectiveness of cognitive behavioural treatment in improving quality of life, as indexed by positive changes in disability, psychological distress and pain in chronic pain patients (Eccleston et al., 2013). Our results are inconsistent with studies reporting no effect of hypnosis on quality of life in patients with idiopathic orofacial pain (Abrahamsen et al., 2008) or fibromyalgia (Bernardy et al., 2011). These discrepancies can be explained by smaller samples of patients, the hypnosis intervention used and the likely additional effect of self-care learning in our study.

Results reported here support other studies demonstrating the relevance of combining hypnosis with other psychological therapy in the modulation of pain perception, as well as the impact of pain on psychological factors (Alladin and Alibhai, 2007; Jensen et al., 2011). Our results are consistent with

studies showing that the addition of hypnosis enhanced treatment outcome in psychological disorders (Kirsch et al., 1995). Hypnosis has traditionally focused on unconscious restructuring and paid less attention to systematic conscious cognitive restructuring (Alladin and Alibhai, 2007) and may have enhanced the expected benefits of self-care learning. We can hypothesize that hypnosis led to a facilitation process of mental anchorage for specific thoughts and cognitions discussed during the self-care exercises.

Finally, we did not find any significant correlation between the pre- and post-treatment for each psychological measures in each group and the pre- and post-assessment time frame. We can conclude that the pre- and post-duration did not influence scores reported by patients on different scales, whatever the treatment group.

There are some limitations to our study. It could be argued that we measured pain and pain impact with subjective indicators such as the health questionnaire assessment. Pain is a subjective experience and can only be measured by subjective report; instruments assessing subjective state by direct report can be subject to fluctuations and bias according to contextual variables (Williams et al., 2012). Obtaining reliable information related to the patient's subjective pain experience through standardized questionnaires provides a powerful means of understanding the potential efficiency of a treatment.

A second limitation lies in the inclusion of patients with different profile in the baseline pre-treatment. Differences between the groups at the baseline can be explained because investigators allocated patients not randomly to the different treatment groups, but based on their previous clinical experience and their interpretation which treatment is suitable for which patient/clinical condition. Indeed, based on our experience with chronic pain patients, individual patient's history and previous treatments tested by patients, our multidisciplinary team allocated patients to one of the group, regardless of the results of the pre-treatment questionnaire. Despite that we cannot directly compare the different group of treatment, the comparisons between pre- and post-treatment conditions evidence the efficiency of biopsychosocial approaches in the improvement of patients' health assessment. The aim of our study was to assess our clinical daily practice with chronic pain patients, regardless of aetiology or psychological profile. Our goal was to define whether the interventions routinely proposed in our centre were clinically appropriate and effective.

A third limitation of our study lies in the lack of data about the number of patients who refused or switched the treatment proposed by the multidisciplinary team, as well as the number of patients who stopped the study before completing all the therapeutic sessions. Because we want to describe daily routine practice, these data would add valuable information to better describe daily clinical routine in our centre.

Some also argued that due to the different time course of the active treatment groups (10 weeks for physiotherapy, psycho-education and psycho-education/physiotherapy; 6 months for self-hypnosis/self-care learning), it could well be that positive impact on health status is in fact (partially) due to the natural course of the chronic pain condition. However, we can consider that over a period of ± 10 years of pain duration, the natural course of chronic pain condition observed within a 9-month period (pre- and post-duration) cannot be different between the different groups, even if treatment duration were different.

Even with statistically significant overall treatment effects reported in our study, one can argue that these differences cannot be considered as clinical relevance. However, according to Kazdin (1999), even little changes can make a real difference (palpable, practical and noticeable) in everyday life to the patient. In our study, this idea of a real everyday life change is supported by the fact that the results of the different health questionnaires point in the same direction of improvement. In the study of Sil et al. (2014), a 8-point reduction in the disability level by the end of treatment could be considered as clinically significant improvement in functional disability for juvenile fibromyalgia patients. In addition, Soer et al. (2012) have shown that a 6.8-point reduction in the PDI can be considered as a clinically important change in patients with chronic back pain. In our study with adult patients and different pain diagnosis, the hypnosis/self-care group showed a 6.3-point reduction in the PDI. However, we need future clinical trials to establish clearer standards for estimating clinical significance and to improve interpretability of treatment outcomes across clinical trials.

This study showed the relevance of biopsychosocial approaches in the reduction in pain and psychological factors such as depression, anxiety and pain disability as well as an improvement in quality of life. We demonstrated a larger impact achieved through the combination of self-hypnosis and self-care learning as compared to psycho-education and/or physiotherapy treatment on patients' health

evaluation. Self-hypnosis/self-care learning proved cost-effective: we observed changes with six intervention sessions, while 20 sessions were needed to obtain limited changes with the physiotherapy/psycho-education, and no change was observed for physiotherapy and psycho-education alone. In a context of a socio-economic crisis, it is essential to develop health intervention treatments with a significant effectiveness combined with a low cost for the patient. Future studies should consider comparing self-care learning and self-hypnosis interventions separately to disentangle the effect of hypnosis from the effect of self-care learning in the management of chronic pain.

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Author contributions

A.V. was responsible for interpretation of data, drafting the article. A.G. was responsible for analysis of data, revising the article. N.M. was responsible for conception and design, acquisition of data, revising the article. I.S. was responsible for conception and design, acquisition of data, revising the article. C.B. was responsible for analysis of data, description of the psychological tests, revising the article. S.G. was responsible for acquisition of data, revising the article. D.M. was responsible for acquisition of data, revising the article. A-S.N. was responsible for analysis of data, interpretation of data, revising the article. M-E.F. was responsible for integrity of the work (conception and design, acquisition of data, interpretation of data, drafting the article).

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