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A short goal-pursuit intervention to improve physical capacity: A randomized clinical trial in chronic back pain patients

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ABSTRACT

The present study tested a short intervention using goal-pursuit strategies to increase physical capacity in pain patients. Sixty chronic back pain patients were randomly assigned to intervention or control conditions. Both groups followed a 3-week conventional back pain program at an outpatient back pain center. Instead of routine treatment, the intervention group received a one-hour intervention consisting of a combination of (a) a goal-setting strategy (i.e., mental contrasting, MC) aimed at commitment to improved physical capacity, (b) a short cognitive behavioral therapy-oriented problem-solving approach (CBT) to help patients overcome the obstacles associated with improving physical capacity, and (c) a goal-pursuit strategy, i.e., implementation intentions (II) aimed at performing physical exercise regularly. At two follow-ups (3 weeks after discharge and 3 months after returning home) the MCII-CBT group had increased its physical capacity significantly more than the control group as measured by both behavioral measures (ergometer, lifting) and subjective ratings. Findings are discussed with relation to the use of the intervention as a specific treatment to increase chronic pain patients' motivation to be physically active.

1. Introduction

Managing chronic back pain means engaging in physical activity. However, back pain patients often develop extensive avoidance behavior [50]. One obstacle to managing their pain is that they anticipate pain in any activity-related situation and therefore avoid activity in general (fear-avoidance-behavior). A second obstacle is patients' beliefs that "passive" treatment (e.g., surgery, massage) is the most effective or the only avenue for pain control. The patients who hope that such "passive" treatment will eliminate their pain are less likely to learn how they can effectively self-manage and overcome their pain.

Hence, one of the main targets in chronic back pain therapy is to motivate patients to engage in physical exercise as one change in their general behavior. Multidisciplinary pain programs for chronic back pain therapy [1,3,4,8,17,19,34,36,49,53] meet this requirement by providing education modules, which include indirect motivation strategies (information about the need for physical exercise). However, no discrete direct motivation techniques are involved. This may be a reason why these programs achieve only low levels of change in physical capacity [17]. The patients often fail to adopt the exercises they have learnt into their everyday routines.

To overcome these deficits, Van Damme et al. [47] have emphasized the importance of motivational aspects in coping with pain and suggest an individual treatment by removing the patients' individual blocks with respect to achieving or changing their goals. Current research is using the stages of change model to determine motivation and to improve treatment efficacy [39]. In this context, one existing motivational approach is motivational interviewing (MI) [25], which has been applied to chronic pain treatment, especially to encourage exercising [9,14,15]. One problem of MI is that it is very extensive and requires several sessions or phone calls.

The aim of our study was to develop and evaluate a concise method for encouraging exercising in chronic back pain patients and consolidating behavioral changes. The chosen strategies facilitate the realization of goal intentions. Mental contrasting (MC) strengthens goal commitment. As a result, persons with high expectations that they will be able to achieve a desired future commit strongly to its realization. Numerous experimental studies measuring commitment to achieving desired futures as the dependent variable support these hypotheses [27,28,30,31].

Implementation intentions (II) enhance the implementation of new behavior. Gollwitzer and Sheeran [6] have reviewed a total of 94 studies adopting the II strategy for goal attainment. Various studies in the domain of exercising behavior report of the effects of a medium to large magnitude with an overall average of $d = .86$ [26,32,38,43,44].

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In addition, we incorporated a CBT-oriented problem-solving approach into the MCII intervention to account for negative effects of chronic pain on cognitive function and to help patients overcome their existing deficits. This approach should provide adequate problem solutions for improving pain-coping strategies.

The patients in the intervention group, MCII-CBT, were expected to display a larger increase in physical exercise than those in the control group, which received a standard intervention program for CBP.

2. Method

2.1. Participants

A total of 75 chronic back pain patients were initially recruited at an outpatient rehabilitation center in Germany. Of this total, 60 patients (80%) participated in the study. Eleven of the dropouts (73%) belonged to the control group and four to the experimental group. Forty of the included patients (67%) attended the follow-up examination at the rehabilitation center three months later and took part in the objective measures (see Fig. 1); the others filled in questionnaires at home and sent them to us or informed us about their condition over the telephone.

The participants were 37 women and 33 men between the ages of 27 and 63 years (mean age at initial assessment = 48 years). Twenty-five percent of the participants also met the criteria for depressed mood measured using the German version of the "Center for Epidemiological Studies Depression Scale" (CES-D) [40]. The cut-off score indicating a relevant depression is 23 points [11]. Sample characteristics are comparable to other studies with chronic back pain in Germany [52].

Inclusion criteria for participation in the present study included the existence of chronic back pain that had persisted longer than 6 months, recurrent or ongoing pain, and diagnoses from the area of chronic unspecific back pain such as "lumbar spine syndrome" or "cervical spine syndrome", as well as radiating back pain lasting longer than three months. Exclusion criteria included radiating inflammable and tumor-induced pain, forthcoming surgery, and potential hospitalization because of a necessary operation or other invasive surgery. In addition, we excluded patients who had strong cognitive impairment due to their medication, other predominant comorbidities (psychopathological findings according to DSM-IV) or patients who were currently undergoing psychotherapy.

2.2. Procedure

The patients meeting the inclusion criteria were randomly assigned to either (a) a control group (treatment as usual = standard outpatient back pain program) or (b) an intervention group (treatment as usual plus the MCII-CBT intervention). The procedure was organized and administered by an independent research associate. The outpatient back pain center included a central therapy planning module for all patients. At this point, randomization was carried out on the basis of our inclusion criteria.

To avoid differential effects between the two treatments due to differences in treatment expectancy and credibility, the patients were kept unaware of their treatment affiliation. All patients were informed prior to treatment that they were taking part in a study to investigate their goals and goal attainment during the back pain program. Both groups had a session (baseline measurement) to fill out questionnaires and to define their goals. Both groups were guided and received the same attention. The participants in the control group were told to implement their goals within the next two sessions of guided physiotherapy while the intervention group were told to do this during the next two sessions with the psychologist, the principal investigator, and received MCII-CBT to enhance goal attainment. No significant demographic and clinical differences were found between the two groups (see Table 1).

2.2.1. Compliance and drop-out rate

We used analyses of variance and χ^2 tests to determine whether those participants completing the study differed systematically from those who terminated their participation. We analyzed demographic variables (gender, age, marital status, school education, occupational status, and unemployment) and pain-related variables (severity of pain, frequency of pain, and degree of depression via CES-D score), ability to work and level of physical disability (ADL score, Hannover Activities of Daily Living questionnaire) [20]. No systematic differences were found between the two groups.

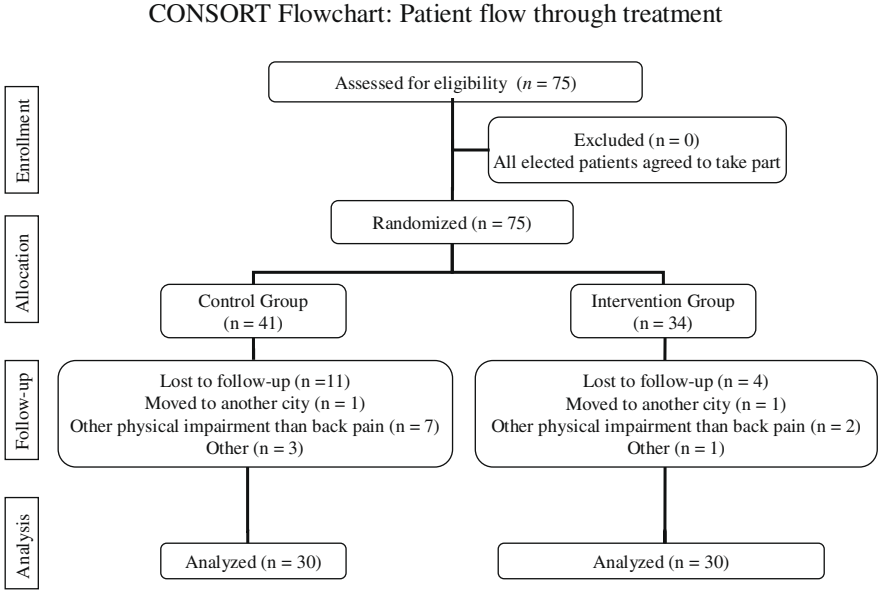

Fig. 1. Flow chart for patients through follow-up including drop-out rate. Excluded ($n = 0$): all elected patients agreed to take part; dropouts ($N = 15$): moved to another city: control group: $n = 1$; intervention group: $n = 1$; other physical impairment than back pain: control group: $n = 7$; intervention group: $n = 2$; other: control group: $n = 3$; intervention group: $n = 1$.

Table 1
Demographic and clinical characteristics/differences between the sample groups.

Characteristic	Intervention group (n = 30)	Control group (n = 30)	Difference F or χ^2 and df
Demographic characteristic			
Gender, female	60%	63%	χ^2 (1, N = 60) = .07, p = .79
Age (years; $M \pm SD$)	47.8 ± 9.6	47.7 ± 9.2	$F(1, 59)$ = .07, p = .99
Ethnicity (n)			χ^2 (3, N = 60) = 1.35, p = .72
German	26	25	
Other	4	5	
School education			U = 412, p = .55
No school education completed	7%	10%	
Elementary school	53%	40%	
Secondary school	23%	27%	
University entrance diploma	17%	23%	
Marital status			χ^2 (3, N = 60) = 1.17, p = .76
Single	27%	30%	
Married	63%	57%	
Divorced/widowed	10%	13%	
Occupational status			U = 404, p = .43
Worker	67%	53%	
Employee	27%	47%	
Homemaker	6%	0	
Ability to work			χ^2 (3, N = 60) = .61, p = .44
Able to work	50%	57%	
Employment			χ^2 (3, N = 60) = .66, p = .42
Employed	80%	90%	
Clinical characteristics			
Severity of pain (NRS score)			
Average	5.7	5.8	$F(1, 59)$ = .02, p = .88
Maximum pain	7.9	8.2	$F(1, 59)$ = .64, p = .43
Frequency of pain			U = 421.5, p = .65
Permanent	43%	37%	
Several times a day	37%	40%	
Once a day	7%	10%	
Every few days	7%	10%	
Infrequent	6%	3%	
ADL score ($M \pm SD$)	69.3 ± 18.05	61.95 ± 14.30	$F(1, 59)$ = 3.07, p = .09
CES-D score ($M \pm SD$)	17.8 ± 7.6	18.0 ± 7.6	$F(1, 59)$ = .01, p = .92

NRS = numeric rating scale (range from 0 to 10; 0 = no pain, 10 = worst conceivable pain); CES-D = Center for Epidemiological Studies Depression scale, ADL = Hannover Activities of Daily Living questionnaire.

The data of participants completing the study were available in full. There were no missing data. No outliers were removed.

2.3. Intervention

As shown in Fig. 2, the intervention in the experimental condition involved two half-hour sessions on day 3 and day 9 after baseline. A trained psychologist (the principal investigator) delivered the modules in one-on-one sessions. The intervention followed a structured procedure consisting of various problem-solving strategies. For example, the intervention focused on identifying, distinguishing, and changing the dysfunctional behavior or attitudes impeding physical exercise.

To begin with, the participants indicated on a 11-point response scale, ranging from 1 (*not at all*) to 10 (*very*), their expectations of success (“How confident are you that you can improve your physical capacity?”) and incentive value (“How important is it to you that you will improve your physical capacity?”). The patients had medium to high expectations of success (M = 6.8, SD = 2.4). There were no differences between the two groups, $F(1, 58)$ = 2.07, p = .16. The patients also exhibited high incentive scores for improving physical capacity (M = 9.6, SD = .87). There were no differences between the two groups, $F(1, 58)$ = 2.73, p = .10.

The first 30-min intervention period started with the mental contrasting strategy. To begin with, the patient, assisted by the psychologist, listed four positive aspects associated with “exercising more” (i.e., increasing physical capacity). For example, the patients listed: getting in shape, having fun, increasing contact with other people, and distraction from pain. Next, the patient, together with the psychologist, listed four negative aspects of the reality standing in the way of exercising more (i.e., obstacles). For example, the patients listed: pain being too intense, lack of time, not wanting to exercise, and being too tired.

Next, the patients verbally elaborated two positive aspects of the desired future and two negative aspects of impeding reality (i.e., obstacles) in alternating order, beginning with the elaboration of a positive aspect of the future. For example, one patient contrasted the positive aspect “I will feel better if I exercise more” with the obstacle “the pain is too intense”. In her elaborations about the positive aspect she mentioned: “My body will then develop more muscles, I will be able to walk further and for longer, I will feel proud of myself”. In her elaborations about the obstacle, the patient mentioned “The pain will become too severe and I won’t be able to move; any movement could cause me harm. I will lie on the sofa, watch TV, and be in a bad mood”. The patients had as much time as they needed to elaborate the positive and negative aspects associated with the goal of improving their exercise behavior. After transcribing the patients’ elaborations, we read them aloud to the patients and gave them the opportunity to add any further comments.

CBT: The aim of the second 30-min intervention session was twofold. Firstly, to assist the participants in identifying beneficial behavior, i.e., behavior that counteracts the obstacles generated in the first session and secondly to form implementation intentions.

We treated the process of overcoming obstacles as a concrete problem analysis. Specifically, we developed bottom-up problem solutions by consulting free problem-solving strategies. We sifted

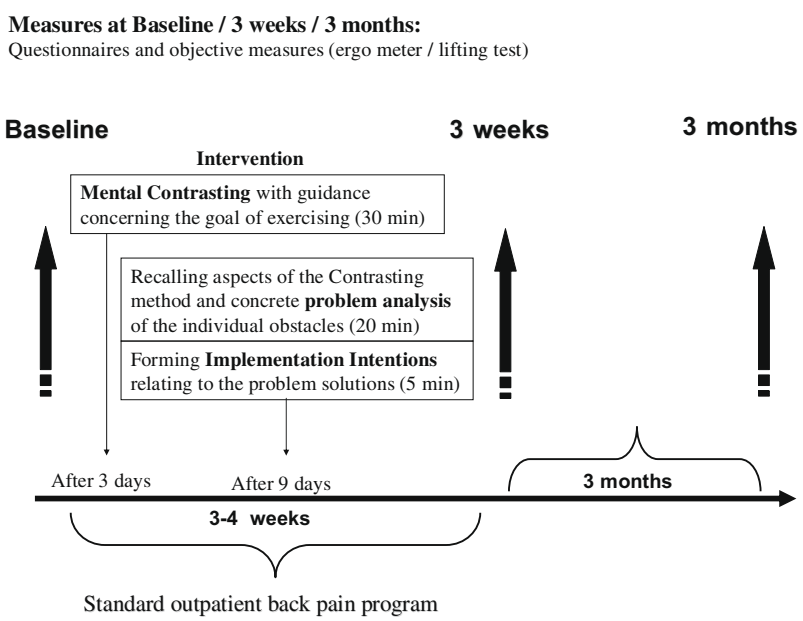

Fig. 2. Time flow of the study. Intervention group: standard outpatient back pain program plus intervention. Control group: only standard outpatient back pain program.

through the obstacles distinguished in advance, in terms of how they related to back pain and their pain-maintaining function. We applied common cognitive behavioral therapeutic principles of problem solving, in particular the strategies of planning changes [16]. We confronted the patients again with their personal obstacles towards exercising and then proceeded to focus on overcoming these obstacles using different cognitive behavioral techniques (e.g., identifying automatic thoughts), challenging the obstacles via a Socratic dialogue [2] and anticipating their capabilities. We provided precise, relevant information about their individual pain behavior based on scientifically proven common knowledge from pain research. We used current, valid pain chronicity models, for example, the "fear avoidance model" [37,50].

Finally, we assisted the patients in the formation of implementation intentions. We outlined the desired behavior in a central statement which covered the when, where, and how of goal-striving, and supported the patients in expressing this in words. For example, one patient wrote in response to the obstacle "fear of pain": "If I am afraid of hurting myself, then I will remember that movement is good against pain". Bearing in mind the cognitive impairments often experienced by chronic pain patients (e.g., deficits in memory, attention, verbal skills, speed, and mental flexibility) we decided to write down the patients' IIs on small cards for them to take home and to help them to remember their if-then plans. This II procedure lasted only 5 min. Fig. 3 shows an example of the intervention modules.

2.4. Treatment as usual

All participants took part in the treatment as usual outpatient back pain program. This program is an intensive, supervised exercise therapy. The patients receive general information about pain (e.g., the relationship between pain and stress, interaction between the psychological and somatic factors of pain) in addition to medical care and consultation, physiotherapy, and physical therapy (e.g., massage) and education (relaxation techniques). Moreover, the European guidelines for the management of chronic non-specific low back pain recommend supervised exercise therapy as a first-line treatment in the management of chronic low back pain [1]. The back pain program lasted three weeks, between 8 a.m. and 5 p.m. on weekdays. All patients received on average 6 h of standard treatment a day. This means a treatment duration of 30 h a week and 90 h overall.

2.5. Control group

The control group took part in the back pain program just like the intervention group (treatment as usual). Within the back pain program, the participants in the control group were treated just like the participants in the intervention group. On the two occasions when we administered the intervention to the experimental group, the control group participated in the standard treatment such as physiotherapy under the guidance of qualified personnel.

2.6. Dependent measures

On day 1 of the back pain program (baseline) and at two follow-up assessments (day 21: release from the back pain program; and day 105: after three months at home) we checked physical capacity and severity of pain. The behavioral observation tests were performed alternately by independent student assistants and the main investigator. We assumed that enhancing physical capacity would have a positive effect on the degree of pain.

We chose pain disability (self-reported ADL) as the primary outcome variable and the other variables measuring physical capacity such as lifting and ergometer, and also pain as secondary variable.

2.6.1. Primary outcome variable: pain disability

To measure the physical capacity we used a 12-item self-report scoring system, the "Hannover Activities of Daily Living questionnaire" (ADL), developed and tested by Kohlmann and Raspe [21,41]. The Hannover ADL instrument has excellent psychometric properties and has been shown to correlate highly with the Roland Morris Scale [42]. The Hannover ADL quantifies the patient's degree of physical functioning, ranging from 0% to 100%. We used the ADL at the three measuring points.

2.6.2. Secondary outcome variables: physical capacity

We also used behavioral measures to quantify the patients' physical status. The patients performed a lifting test and a bicycle

Wish to exercise

Mental Contrasting

Positive aspects	**Obstacles**
• being fitter	• pain is too strong
• having fun	• not enough time
• having more contact with other people	• not feeling like exercising
• being distracted from pain	• tiredness
Example of mental elaborating:	
"I would feel better if I exercise more. My body will then develop more muscles, I would be able to walk further and for longer, I would feel happy about myself".	"Pain is too strong so that I am unable to move; any movement could cause damage. While moving pain would get higher and higher and I would need more pills."

CBT-orientated Problem-Solving: Dealing with the fear of moving: Telling the patient that …

- moving does not cause damage
- exercising is effective against the pain triggered by muscle tension
- avoiding to move enhance the fear of moving and cause more pain

Implementation Intentions: Making if-then-plans

"If I am afraid of causing damage to myself I will remember that movement is good against pain"

"If it is Monday or Wednesday at five o'clock I will go to the fitness studio after work and exercise"

Fig. 3. Example of the intervention modules.

ergometer test at all three measuring points. Specifically, we designed the lifting test based on the capacity assignment "handling load" of the "Functional Capacity Evaluation" (FCE) [7]. The patients' task was to lift a box weighing 5 kg as often as possible within 2 min: to waist height, to eye level, and 60 cm above the ground. In two trials we recorded the number of lifts.

The bicycle ergometer test, comparable with the FCE [8], is a capacity test, similar to a stress electrocardiogram. We measured capacity via the heart rate of 200 minus age. The initial load was 25 W. After 2 min the load was increased to 50 W and so on. The patients continued on the ergometer as long as none of the following criteria were reported or observed: exhaustion, breathlessness, dizziness and excessive pulse. We recorded the wattage achieved and time exercised.

2.6.3. Secondary outcome variables: pain severity

We measured severity of pain using the numeric rating scale (NRS) from Von Korff et al. [51]. This self-report pain scale ranges from 0 (*no pain*) to 10 (*worst conceivable pain*). The patients indicated their current pain (pain at the moment of measurement), average pain (average pain during the last four weeks), and maximum pain (maximum pain during the last four weeks).

2.7. Statistical analyses

A 3 × 2 (time by group), mixed-design, repeated analysis of variance (ANOVA) was computed. An alpha level of .05 was used for all statistical tests. Treatment (treatment as usual vs. treatment as usual plus the intervention) served as a between-subjects factor and time (baseline vs. the two follow-up treatment scores) served as a within-subjects factor. We predicted treatment × time interaction effects. A significant interaction effect indicates the degree of change between the baseline and the two follow-up treatment scores for a dependent measure depending on the treatment conditions.

We used the intention-to-treat analysis as our main analysis. Due to the fact that our data are nearly complete, we obtained identical results to the per protocol analysis. Only for single condition did we have to calculate the missing data. These were patients who could not participate in the examination for the 3-month follow-up assessment so that the ergometer and lifting test results are missing. These patients did not drop out of the entire analysis. They completed their treatment. The other data from the 3-month follow-up questionnaires are available. At the time of the 3-month follow-up assessment, 20 patients were not present in person (10 in each group). The causes of absence were either job-related (control group $N = 7$, intervention group $N = 8$) or health-related (control group $N = 3$, intervention group $N = 2$). We therefore conducted intention-to-treat analyses [46] using the LOCF (Last Observation Carried Forward) method.

To calculate an improvement rate (clinically relevant), we used a tool proposed by Jacobs [13]. We computed standard effect sizes and corrected effect sizes for time × group interaction effects. The effect size *d* was calculated to indicate the difference between baseline values and follow-up values after the intervention and to demonstrate the difference between the two groups. The standard effect size was defined as the mean baseline value minus the mean follow-up value divided by the pooled standard deviation of both ($d = [M$ baseline $- M$ follow-up]/pooled standard deviation).

In addition, we chose the calculation of corrected effect sizes to reflect the effect of the interaction between conditions and time, namely the different changes of the groups. According to Hartmann et al. [10] the calculation of the corrected effect size involves a more complex formula for a pooled standard deviation which contains the sample sizes of the intervention and control groups at both pre- and post-treatment. Overall, separate within- and between-group effect sizes were available. The confidence interval for all effect sizes was 95%.

3. Results

The data shown in Table 2 and Fig. 4 seem to suggest that the intervention had a positive effect on physical capacity. The control group which only engaged in "treatment as usual" displayed significantly less change in physical capacity than the intervention group, especially after three months at home.

3.1. Pain disability

Standardized questionnaire ADL. The time × group interaction was significant, $F(2, 116) = 5.95$, $p = .01$, $\varepsilon = .90$, $d = .77$ (Fig. 4a).

Table 2
Physical capacity measured using the Hannover ADL, lifting test and ergometer test.

Measure	Group	Baseline		Release		Follow-up		*F*	*d*
		M	SD	*M*	SD	*M*	SD		
ADL score	IG	61.9	14.3	69.6	13.4	74.7	16.8	6.0*	.77
	CG	69.3	18.1	70.6	17.1	68.1	23.7		
Lifting test (number of lifts)	IG	29.2	16.3	38.7	13.1	44.0	14.0	6.3*	.97
	CG	28.8	12.8	29.5	18.2	27.3	18.9		
Ergometer test (W)	IG	119.3	42.2	134.1	35.0	138.4	36	3.9*	.63
	CG	130.4	44.6	131.5	49.6	120.7	56.2		
Intention-to-treat analyses									
Lifting test (number of lifts)	IG	27.8	15.8	35.4	15.9	39.1	17.4	6.1**	.77
	CG	28.2	11.8	27.8	17.7	26.0	18.1		
Ergometer test (W)	IG	113.3	38.1	125.8	36.8	129.2	38.3	3.1*	.53
	CG	125.8	43.3	127.5	47.0	119.2	52.0		

ADL = Hannover Activities of Daily Living questionnaire; ADL test: $n = 60$; lifting test: $n = 40$; ergometer test: $n = 40$; IG = intervention group; CG = control group; F = F-test for repeated measures ANOVA treatment × time factor; $^{*}p < .05$; $^{**}p < .01$; d = effect size between baseline and follow-up; intention to treat: LOCF method (last observation carried forward).

The intervention group showed an increase in physical capacity as measured using the standardized questionnaire Hannover ADL, simple time effect of intervention group: $F(2, 58) = 8.97$, $p < .01$. The control group showed no variation in its physical capacity, simple time effect of control group: $F(2, 58) = .44$, $p = .65$.

3.2. Physical capacity

Lifting test. The ANOVA revealed a significant time × group interaction effect, $F(2, 116) = 6.06$, $p < .01$, $\varepsilon = .84$, $d = .77$ (Fig. 4b). The result of the per protocol analysis was $F(2, 86) = 5.01$, $p = .01$, $\varepsilon = .88$, $d = .97$. The intervention group increased the number of lifts achieved during the lifting test at the 3-week and 3-month follow-up assessment, simple time effect of intervention group: $F(2, 58) = 9.47$, $p < .01$, baseline/3 weeks: $F(1, 58) = 8.75$, $p < .01$, 3-week/3-month follow-up: $F(1, 58) = 4.28$, $p = .05$. The control group showed no increase, simple time effect of the control group: $F(2, 58) = .34$, $p = .70$.

Ergometer test. The ANOVA revealed a significant time × group interaction effect, $F(2, 116) = 3.30$, $p = .04$, $d = .55$ (Fig. 4c). The result of the per protocol analysis was $F(2, 86) = 3.85$, $p = .04$, $d = .63$.

The intervention group showed an increase in its maximum achieved wattage, simple time effect of intervention group: $F(2, 58) = 6.02$, $p < .01$. The control group achieved no significant increase in its ergometer test capacity, simple time effect of control group: $F(2, 58) = .68$, $p = .49$.

3.3. Pain severity

Both groups reported of experiencing less pain after the back pain program (after 3 weeks) at the current, average, and maximum pain level (Table 3). However, none of the time × group

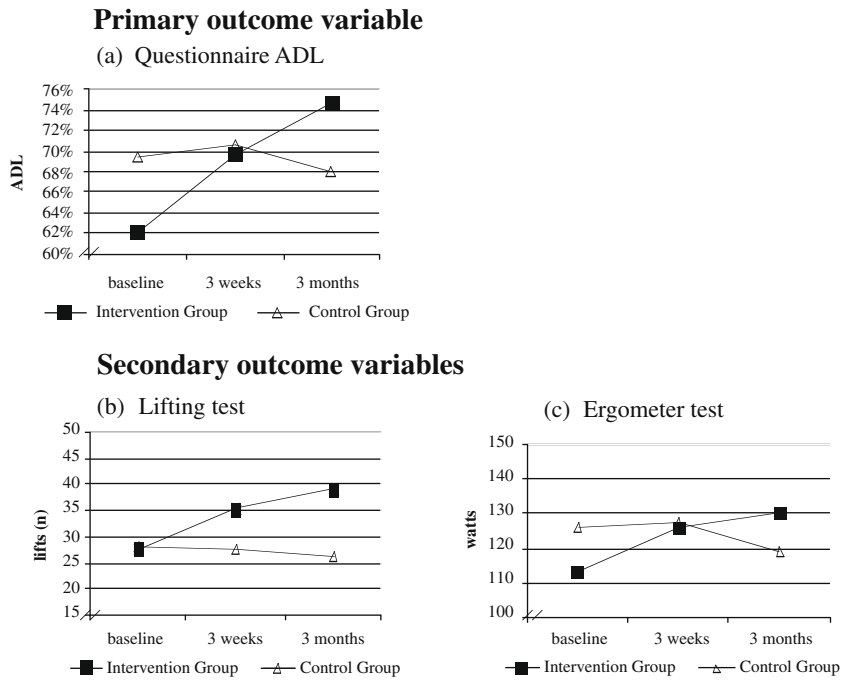

Fig. 4. (a) Physical capacity measured using a standardized questionnaire, the Hannover ADL. *X*-axis: time (baseline = admission back pain program, 3 weeks = release from back pain program, 3 months = follow-up after 3 months at home); *Y*-axis: ADL score in%, score ranges from 0% to 100%. (b) Physical capacity measured using lifting test (number of lifts achieved). *X*-axis: time (baseline, 3 weeks, 3 months); *Y*-axis: number of lifts achieved within 2 min. (c) Physical capacity measured using ergometer test (maximum wattage achieved). *X*-axis: time (baseline, 3 weeks, 3 months); *Y*-axis: maximum wattage achieved, starting from 25 W.

Table 3
Severity of pain (current, average and maximum NRS score).

Measure	Group	Baseline		Release		Follow-up		*F*	*d*
		M	SD	*M*	SD	*M*	SD		
NRS current	IG	6.3	2.1	3.7	2.1	3.8	2.7	2.7	n.s.
	CG	5.3	2.3	4.2	2.2	3.9	2.4		
NRS average	IG	5.7	1.7	4.6	1.7	3.5	2.7	0.8	n.s.
	CG	5.8	1.8	4.8	1.9	4.3	2.2		
NRS maximum	IG	7.9	2	6.8	2.2	5.2	2.8	2.1	n.s.
	CG	8.2	1.6	6.5	2.2	6.4	2.3		

IG = intervention group; CG = control group; *F* = *F*-test for repeated measures ANOVA treatment × time factor; n.s. = not significant.

interaction effects were significant, current pain: $F(2, 116) = 2.65$, $p = .08$; average pain: $F(2, 116) = .81$, $p = .45$; maximum pain: $F(2, 116) = 2.06$, $p = .14$. The groups showed no significant differences or changes in the level of pain experienced.

4. Discussion

This study is the first test of an intervention based on MC and IIs aiming to change the behavior in a clinical population as part of a therapeutic program. The findings indicate that the intervention led to significantly greater improvements in physical capacity compared with the usual treatment directly after the intervention and over a 3-month period at home, although, surprisingly, no significant differences emerged between the groups with regard to the pain experienced (intervention group: $d = 1.03$; control group: $d = .60$). The intervention group increased its physical capacity at the two follow-up assessments as measured by subjective and behavioral measures. The control group showed no significant change in physical capacity. The differences in the physical capacity achieved by the two groups had effects of a medium to nearly large magnitude (Hannover ADL score: $d = .77$; lifting: $d = .77$; ergometer: $d = .55$).

The beneficial effect observed in the intervention group is clinically relevant. Increasing the initiation of the physical exercising and its maintenance beyond therapy is a central and one of the most problematic issues in chronic back pain therapy. Our results display external validity because our sample is comparable to large epidemiological study samples with back pain in Germany concerning pain disability or other characteristics such as depressive mood [20,41,52].

Our results show that strengthening a patient's commitment to improving physical capacity and formulating concrete implementation strategies like if-then plans ensures goal realization in the long run. These results are in line with the studies in other non-clinical areas, e.g., healthy women on a diet and increasing daily exercise [45].

With MC the future becomes something to be achieved and the present reality becomes an obstacle to be overcome. As a result, persons with high expectations of achieving a desired future commit strongly to its realization. The patients in our study had a medium to high expectations of success ($M = 6.8$, SD = 2.4) and the patients in the intervention group realized their goal, supporting the goal-pursuit theory. For clinical considerations it is important to integrate this new intervention into the theoretical framework of the CBT-oriented procedure. Our starting point for developing the new intervention was the fact that back pain patients often show passive attitudes towards activity change. One explanation for the effectiveness of our intervention is that it is a mental strategy to help patients actively confront and overcome their obstacles. The patients identify and face their obstacles through the use of MC and achieve goal-oriented thoughts by providing a new strategy for handling problems.

The models of fantasy realization [26] and implementation intentions [5] are well suited for incorporation into CBT. They elucidate cognitive mechanisms and they are not rival hypotheses to conditioning theories. In the sense of higher-order cognitive mediation, they can be combined within S–O and O–R relations [18]. In this context, they explain the complexity of cognitions as organism variables and represent an elaborate bridge to behavioral flexibility.

4.1. A cost-effective intervention?

An important advantage of the intervention is its quick implementation, saving both time and money. The intervention consisted of two sessions, lasting 1 h in total. We omitted the customary-detailed assessment and behavioral problem analysis which usually takes approximately 4 h. The intervention follows the goal discourse with the patient and refers to the increase in exercise. Other short-term psychological interventions take at least 4–6 h [24]; for a review see the findings of the "Cochrane Back Group" [33]. Studies including CBT-oriented problem-solving approaches involve multiple sessions (e.g., 19 half-day sessions over the course of 8 weeks in the study by van den Hout et al. [48]).

In addition, drop-out rates in the present study were very low in the intervention group (13%), suggesting that the participants were highly satisfied with the quality of their treatment. One explanation could be that for the patients the approach came across as clear and transparent. Despite the fact that the new intervention is an individual problem-solving approach with individual implementation intentions, it follows a standardized structured procedure.

4.2. Adjustment of MCII for chronic pain patients

Unlike non-clinical studies using MCII as a self-control strategy [45], in this study it was necessary to "coach" pain patients through an intervention. Furthermore, we used a short CBT-oriented problem-solving approach with regard to patients' obstacles to provide additional support in achieving the goal of exercising more. It is a fact that pain patients often spend years trying to change their exercising behavior but fail to do so, e.g., due to a lack of knowledge about how to behave, fear of more pain or other negative anticipations. Moreover, many authors have found remarkable effects of chronic pain on cognitive function [22]. The CBT problem-solving approach encouraged the pain patients to test and implement adequate new behavior so that they were able to overcome the chronic obstacles and achieve their goal of exercising more.

4.3. Application of MCII-CBT to psychological pain treatment

Our MCII-CBT intervention could be applied to psychological pain treatment in several ways. The intervention could become a component of individualized personal instruction sessions or group therapy. The patients could be enabled to carry out the intervention independently (i.e., as a metacognitive strategy) and apply it to other behavior goals. In the area of the prevention of chronic pain, the intervention could be integrated in multimodal assessment programs as a short-term psychological intervention for sub-acute or chronic back pain patients. Another possible field of application might be the prevention of failed back surgery. Adopting the intervention prior to back operations could help patients to enhance post-operative mobilization [29]. Activating depressive patients might also be a domain for the intervention.

4.4. Limitations

Despite these strong beneficial effects of the intervention in chronic back pain patients, certain limitations of the study must

be acknowledged. Due to the fact that there was no closed waiting list for the outpatient back pain program, one limitation of the present design is that we included no control group without any treatment. However, any type of therapy of back pain patients is usually more effective than that of the waiting list control group [12]. Against this background, it seemed difficult from an ethical point of view to justify withholding treatment from patients.

Another limitation of the study is that we had no control group with a pure CBT intervention for comparison. Theoretically any form of CBT added to usual care could have produced similar changes. However, for all practical purposes and to our knowledge no meaningful sole CBT intervention exists that lasts 1 h, except for relaxation training or some kind of activity. A total of two half-hour CBT units are unusual. For this reason we decided that the control persons should instead receive two half-hour-guided physiotherapy sessions while the intervention group had MCII-CBT, ensuring that the intervention was controlled for attention.

Differential effects between the two treatments may also be due to differences in treatment expectancy and credibility. More varied and elaborate treatments may generally be considered more credible by participants than more simple treatments. Advising patients about the treatment's positive expectations could improve the outcome. We tried to control this point in our setting by randomization and the equal information of the patients, and intentionally decided against informing them about the special aspects of the treatment. We integrated the treatment into the back pain program and the patients were unaware of their treatment affiliation.

Unfortunately we did not include a measure of pain-related fear in our study. Daily exposure to activities might have reduced fear of pain. However, because of the controlled condition this was true for both groups. We expected that MCII-CBT had previously increased the implementation of daily activities, and then reduced fear of pain could have enhanced goal completion. We simply conducted an outcome measure, but we did not observe the number and intensity of daily activities.

A further limitation of the study is that there was only one therapist (the principal investigator) providing the intervention. It is unclear whether treatment integrity was achieved. Establishing treatment integrity is an important factor for ensuring intervention success. According to Perepletchikova and Kazdin [35], we achieved the necessary treatment integrity, e.g., the performing therapist made a major contribution to the development of the treatment. Hence, treatment acceptance, understanding and acquirement by the therapist were high. The therapist was carefully trained in several pre-tests and ongoing supervision took place to ensure accuracy and consistency. A further advantage of the treatment is the small amount of time that was required for its implementation so that the differences were likely to be small. Notes of the treatment elements are available. By applying a Method of Assessing Treatment Delivery (MATD, see Leeuw et al. [23]), for example, we could check the verification of treatment delivery afterwards.

5. Conclusion

Future research into chronic back pain patients might focus on comparisons of CBT and the MC-II intervention to review their efficacy. Overall, the present findings suggest that the combination of MC, CBT-oriented problem solving and II is a powerful technique that helps people to translate goals into actual behavior.

6. Summary

The examined short intervention using mental contrasting, implementation intentions and CBT-oriented problem-solving strategies helps to increase the physical capacity in chronic back pain patients.

Conflict of interest

We confirm that there is no possible conflict of interest (including financial and other relationships) for each of the authors.

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