Spine

SPINE Volume 36, Number 11, pp 1–8

RANDOMIZED TRIAL

The Effects of Therapeutic Climbing in Patients with Chronic Low Back Pain

A Randomized Controlled Study

Kai Engbert, PhD, and Michaela Weber, MSc

Study Design. A randomized controlled study investigated the effects of therapeutic climbing in patients with chronic low back pain. Before and after 4 weeks of training, physical and mental well-being were measured by two questionnaires (36-Item Short Form Health Survey [SF-36]; Hannover Functional Ability Questionnaire for measuring back pain–related disability [FFbH-R]).

Objective. Therapeutic climbing has been suggested to increase muscular strength and perceived physical and mental well-being. This study focused on the psychological effects of therapeutic climbing and compared it with standard exercise therapy.

Summary of Background Data. Therapeutic climbing has become increasingly popular in rehabilitation and its effects on muscular strengthening have been shown. Therapeutic climbing has also been suggested to yield psychological effects such as changes in attentional focus from pain to physical capabilities. To date, no controlled clinical trial has investigated these psychological effects and it is unclear whether therapeutic climbing is comparable or superior to other forms of exercise.

Methods. Twenty-eight patients with chronic low back pain conducted either a therapeutic climbing or a standard exercise regime. Each program took 4 weeks, including four guided training sessions per week. Before and after the program, patients answered two questionnaires assessing their physical and mental well-being.

Results. For the Hannover Functional Ability Questionnaire for measuring back pain–related disability, there was no difference before *versus* after or between the treatments. For the SF-36, both treatments showed significant improvements in 3/8 subscales of the SF-36. In 2/8 subscales, only the participants of the therapeutic climbing improved and in 1/8 subscales the converse was true. Comparing both groups, significantly larger improvements were found after therapeutic climbing in two subscales of the SF-36: physical functioning and general health perception.

Conclusions. The benefits of therapeutic climbing were comparable with those of a standard exercise regime. In two subscales of the SF-36, the benefits of therapeutic climbing exceeded those of standard exercise therapy, primarily in perceived health and physical functioning of the patients. This finding demonstrates that therapeutic climbing is equivalent and partly superior to standard exercise therapy for patients with chronic low back pain.

Key words: chronic low back pain, therapeutic climbing, rehabilitation, psychological aspects, physical and mental well-being. **Spine 2011;36:1–8**

Low back pain is a major public health problem with significant socioeconomic costs.[1–4] From demographic, psychosocial, and occupational factors, chronic low back pain has been shown to be strongly related to immobility, muscular impairments, and avoidance behavior.[5–7] The so-called deconditioning syndrome in low back pain includes impairments in back extensor muscle force, endurance, and spinal mobility.[8–12] Multiple studies have shown exercise therapy to be an effective treatment to reduce pain-related disability and severity.[13–15] Stabilization exercises have been shown to significantly improve pain, well-being, and occupational status.[16–18] Alternative forms of exercise such as yoga have also been successfully applied to chronic low back pain.[19–23] Tekur *et al*[24] found that a yoga-based exercise program reduced pain-related disability and improved spinal flexibility better than stabilization exercise did. The diversity of effective regimes indicates that the benefit of exercise therapy in chronic low back pain cannot be attributed to muscular strengthening alone. Associated psychological processes such as changes in attentional focus and reduction of avoidance behavior are crucial in reducing deconditioning and have been successfully addressed in cognitive and behavioral therapies for chronic low back pain.[25–30]

In this study, we investigated therapeutic climbing in facilitating both muscular training and psychological changes related to pain, avoidance behavior, and body experiences. Therapeutic climbing was chosen because it mostly involves core and trunk muscles and allows specific and variable training of muscular impairments. Moreover, it occurs in a

From the Department of Sport Psychology, Technical University Munich, Munich, Germany.

Acknowledgment date: October 26, 2009. First revision date: January 20, 2010. Second Revision date: March 8, 2010. Acceptance date: April 9, 2010.

The manuscript submitted does not contain information about medical device(s)/drug(s).

No funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Address correspondence and reprint requests to Kai Engbert, PhD, Department of Sport Psychology, Technical University Munich, Connollystr. 32, 80809 München, Germany; E-mail: ke@kai-engbert-sportpsychologie.de

DOI: 10.1097/BRS.0b013e3181e23cd1

motivating and meaningful environment that naturally reinforces economic movements and flexible use of the whole body. Psychologically, therapeutic climbing allows patients to make corrections and reduce pain-related fear and avoidance behavior, and it facilitates attentional change from pain to a positive attitude toward the body. Recently, the use of therapeutic climbing has become increasingly popular in neurological[31,32] and psychosomatic rehabilitation.[33,34] Heitkamp *et al*[35,36] investigated the effects of therapeutic climbing in patients with back pain and found it produced higher lateral flexion and general power and better muscular balance than did a standard training program. However, the psychological benefits of therapeutic climbing have not been investigated to date. This study focused on changes in the subjective experience of physical and mental well-being, as well as on perceived abilities in activities of daily living (ADL).

To evaluate the effectiveness of therapeutic climbing, we used questionnaires to measure physical and mental well-being (36-Item Short Form Health Survey [SF-36])[37–39] and abilities in ADL (Hannover Functional Ability Questionnaire for measuring back pain-related disability [FFbH-R])[40] before and after a therapeutic climbing program. The SF-36 is a widely used self-report questionnaire that surveys physical and mental health status in clinical practice and research. It allows norm-based scoring on the basis of large and diverse populations and is an established standard measurement for monitoring change in a clinical context.[41] The FFbH-R is a German questionnaire that especially focuses on daily activities limited by back problems. It contains 12 ADLs such as picking up a book from a shelf or putting on socks. Patients are asked to rate their ability on each activity on a three-step scale. We hypothesized that therapeutic climbing would, similar to standard exercise training, result in improvements in perceived physical and mental health and fewer disabilities in ADL of patients with chronic low back pain. Moreover, therapeutic climbing focuses on exploration of movements and possibilities instead of focusing on the back- and movement-related pain. Thus, we hypothesized that therapeutic climbing would result in improvements that exceeded those accomplished by standard exercise training.

MATERIALS AND METHODS

Setting

The study was conducted in a German rehabilitation center. The institutional review board approved the protocol, and all study patients gave written informed consent before participation. The information stated that the study was intended to compare two exercise programs. Participants did not know the hypothesizes in detail (*i.e.*, which of the programs was expected to be superior). Because both programs were performed in the same building, participants may have learned about the treatment of the alternative exercise group. However, it was possible to use the climbing wall and the training facilities only during the scheduled sessions. The amount of specific exercise (climbing therapy *vs.* exercise therapy) was therefore limited to the training sessions as described. Participants of both groups were free to do unspecific exercise, such as walking, in their free time.

Randomization

Participants were randomly assigned to the therapeutic climbing or the standard exercise training by means of a computer-generated randomization scheme. Numbered envelopes were prepared by a physical therapist not involved in the study and assigned to patients in a sequential order.

Patients

Physiotherapists screened consecutive outpatients and inpatients of the rehabilitation center who were applied to exercise therapy. Inpatients received convalescent care and were not hospitalized due to severe debilitating pain. All patients experienced nonspecific chronic low back pain in ADL and at work. Treatment was based on individual indication and was comparable for inpatients and outpatients. On the basis of orthopedic diagnostics, it included physical and exercise therapy, relaxation, massage, health education, and psychotherapy. The criteria for *study inclusion* were age between 18 and 65 years and confirmed nonspecific cause of chronic low back pain for longer than 3 months. The criteria for *study exclusion* were radicular symptoms such as radiating pain below the knee, loss of sensation, muscle dysfunction, or loss of reflexes, as well as acute disc prolapse, low back surgery within the last 6 months, tumor, fractures, and other specific and serious causes of back pain. None of the patients were rejected from randomization or excluded due to general health issues such as cardiovascular disease, extremity injuries, or arthritis. After screening, patients (N = 28) were randomly assigned to the experimental (therapeutic climbing, N = 14) or the control group (standard exercise therapy, N = 14). Patients who did not attend more than 30% of treatment sessions were excluded from subsequent data analysis. Overall, five patients were excluded, 4/14 (29%) in the therapeutic climbing group and 1/14 (8%) in the standard exercise group. This difference was statistically not significant. Reasons for missed sessions were overlaps in the training schedule or private schedule difficulties. None of the participants in the therapeutic climbing group dropped out due to climbing specific complications such as shoulder or knee pain. Data analysis is based on 23 patients, 10 from the therapeutic climbing group and 13 from the standard exercise group.

Therapeutic Climbing

The climbing wall was located in the gym of the rehabilitation center. The lateral length of the wall was approximately 4 m, the longer side measuring 3 m. It was 2.5 m tall and equipped with 83 duroplastic holds of different sizes, shapes, and colors (Figure 1). The horizontal and vertical distance between holds varied, and their arrangement was not changed throughout training. The floor in front of the climbing wall was covered with several gym mats. To prevent injury, the therapist allowed only two patients to use the wall at a time. For each participant, the therapist documented exercise at the climbing wall and individual performance. Patients assigned

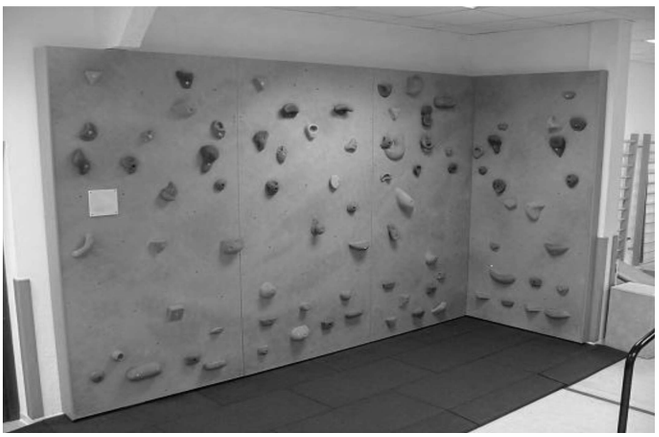

Figure 1. A therapeutic climbing wall. The total lateral length is 4 m and the height is 2.5 m. The wall is equipped with duroplastic holds of different sizes, shapes, and colors.

to therapeutic climbing were given 4 weeks of training with four training sessions per week, resulting in an average of 14 training sessions for each participant. Each training session took approximately 45 minutes, including a standard warm-up of 10 to 15 minutes and about 30 minutes of therapeutic climbing. At the start of climbing, a specific warm-up occurred on the wall. Patients were instructed to laterally traverse at the wall and were free to use all of the holds. After the warm-up, the therapist gave instructions for exercises on the climbing wall designed for coordination, stabilization, and trunk muscle training. Occasionally other equipments were used, such as Frisbees and small balls. Because of the different sizes and shapes of the holds, each exercise could be adapted to the abilities of the patients to give all a taste of success. Usually at the end of each session, patients did a difficult but fun exercise (climbing blindfolded, traversing without using a certain hold, collecting small items placed in holds). Unlike sport climbing, where small holds are used to increase the difficulty of the movements, therapeutic climbing does not aim at strengthening of the upper body. In contrast, it focuses on movement capabilities by using the whole body. Its intensity, overall as well as for the arms and the upper body, does not exceed that of a back specific stabilization exercise. Hence, therapeutic climbing is suitable for the population of patients found in back pain rehabilitation.

Exercise Therapy

Patients assigned to standard exercise therapy were given 4 weeks of training with four training sessions per week, resulting in an average of 13 training sessions for each participant. Every session lasted approximately 45 minutes and took place in a gym equipped with all necessary training units. Eight to 10 patients trained together in a group. They were observed and guided by therapists but were not given instructions for individual exercises. Each session began with a warm-up with an exercise bicycle or a fitness ball made of soft elastic polyvinyl chloride. After the warm-up, the therapist gave instructions for exercises designed for stabilization and trunk muscle training. These exercises were identical for all patients and varied from session to session. Overall, exercises involved strengthening, stretching, mobilization, coordination, and stabilization for the abdominal, back, pelvic, and lower limb muscles. Training units such as fitness and gymnastic balls were used occasionally. At the end of each session, cool-down and relaxation exercises were conducted for approximately 10 minutes. No additional exercise treatments were given for the groups, but a training in proper body mechanics for ADL was given as a separate lesson to all patients included in this study. All patients were free to do sports in their spare time.

Outcome Measures

At the initial evaluation, participants completed a standardized demographic form that included sex and age. All clinical information was taken from the patient record. Patients completed self-report questionnaires measuring physical and mental health (SF-36) and functional disabilities (FFbH-R) during the initial evaluation (baseline) and after the treatment (follow-up). The baseline questionnaires were completed in the beginning of the first session, the follow-up questionnaire at the end of the last session.

Physical and Mental Health

The primary outcome variable of this study was subjectively perceived physical and mental health as measured by the SF-36, which includes 36 questions, each scoring on a five-level response scale. The SF-36 is a generic health status questionnaire that obtains patients' assessments of their functioning, well-being, and standard health over the last 4 weeks. The items are aggregated into eight scales: physical functioning, role limitations caused by physical problems, bodily pain, standard health perception, vitality, social functioning, role limitations caused by emotional problems, and mental health perceptions. These scales form two distinct higher order clusters: the first four scales correlate most highly with physical health, and the latter four contribute most to the scoring of mental health. For the physical health cluster, the lowest possible score (0) indicates "limited a lot in performing all physical activities including bathing or dressing" and the highest score (100) indicates "performs all types of physical activities including the most vigorous without limitations due to health." The lowest score for the mental health cluster (0) indicates "feelings of nervousness and depression all of the time," whereas the highest score (100) indicates "feels peaceful, happy and calm all of the time." The SF-36 has been recommended as the preferred choice for measuring change in a clinical context and demonstrated high levels of reliability in previous studies of patients with low back pain.[40,42,43]

Functional Disability

To assess how far the patients were restricted in ADL, we used the FFbH-R.[41] It is a short, 12-item, self-administered questionnaire that assesses functional limitations in ADL in patients with musculoskeletal disorders (subjects can choose among "yes," "yes with trouble," and "no," or "with the help of another person" to answer questions such as "Can you wash your hair in the washbasin?"). Data from different

studies indicate that the FFbH-R meets the relevant psychometric criteria and is sensitive to change.[41]

Statistical Analysis

Statistical analysis was performed with the SPSS 16.0 version for Windows program (SPSS Inc., Chicago, IL). The normal distributions of data were checked with the Kolmogorov-Smirnov test and nonparametric analyses were used when appropriate. For comparison of the pre- and posttreatment questionnaire data, the Wilcoxon-signed rank test was used. For comparison between groups, the Mann-Whitney *U* test was used. Data were analyzed as mean (SD) scores and a two-sided α-level of 0.05 was used to determine statistical significance for all tests.

RESULTS

The mean age of the 23 study participants was 48.7 (SD = 9.7) years; 12 (52%) were women. No significant differences in sex and age were noted between treatment groups and no differences in the SF-36 subscales or the FFbH-R between the therapeutic climbing and standard exercise groups were observed. A summary of baseline characteristics for each group is provided in Table 1.

For all patients evaluated as a group, there were significant improvements in all SF-36 subscales (all $P < 0.05$) except general health perception ($P = 0.106$). There was no difference in the FFbH-R before *versus* after treatments ($P = 0.237$). For the therapeutic climbing group, significant improvement was observed in five of the eight SF-36 subscales: physical functioning ($P = 0.005$), general health perception ($P = 0.007$), vitality ($P = 0.009$), mental health perception ($P = 0.012$), and social functioning ($P = 0.040$). No difference was found in the subscales bodily pain, role limitations caused by emotional problems, and role limitations caused by physical problems (all $P > 0.05$). There was no difference in the FFbH-R before *versus* after treatments for this group ($P = 0.575$). For the standard exercise group, there was significant improvement in four of the eight SF-36 subscales: vitality ($P = 0.011$), role limitations caused by physical problems ($P = 0.041$), mental health perception ($P = 0.005$), and social functioning ($P = 0.022$). No difference was found in the subscales physical functioning, general health perception, bodily pain, and role limitations caused by emotional problems (all $P > 0.05$). There was no difference in the FFbH-R before *versus* after treatments for this group ($P = 0.229$). Table 2 summarizes the results of the SF-36 subscales and the FFbH-R before and after training for both groups.

A comparison of the groups showed significantly larger improvements for the therapeutic climbing group in two of the eight SF-36 subscales in the physical health cluster: physical functioning ($P = 0.010$) and general health perception ($P = 0.018$). Figure 2 compares this difference (before *vs.* after) for the two groups and Table 3 gives the statistics between groups. In all other subscales of the SF-36 and in the FFbH-R, no difference between the treatments was found (all $P > 0.05$).

TABLE 1. Baseline Characteristics of the Two Treatment Groups*

Variable	Therapeutic Climbing	General Exercise
N	14	14
Patients excluded because of <70% participation	4	1
Rate of participation (%)	81	78
No. of inpatients	7	7
No. of outpatients	3	6
Age, overall (years)	51.9	50.4
Sex	6 female, 4 male	6 female, 7 male
No. of psychotherapy patients	3	5

**Rate of participation was calculated: 100/scheduled sessions × attended sessions. The table gives the mean for each group. No significant difference in the participants excluded (P = 0.146), the rate of participation (P = 0.067), the ratio of outpatients (P = 0.600), psychotherapy (P = 0.464), age (P = 0.519), or sex (P = 0.843) was found between the two treatment groups.*

DISCUSSION

This study compared the benefits of therapeutic climbing and standard exercise in a randomized clinical trial. It emphasized improvements in perceived mental and physical health (SF-36) and perceived abilities in ADL (FFbH-R).

Patients displayed baseline values of the SF-36 and FFbH-R comparable to those described in other studies on chronic low back pain.[20,21,41,44] After the interventions, neither the therapeutic climbing nor the standard exercise group showed significant improvement in the measure of disabilities in ADL (FFbH-R). However, for both groups significant improvements occurred in three of the eight subscales of the SF-36 (vitality, mental health, and social functioning). In one of the eight subscales (physical role limitation), only the exercise group showed statistical improvements. In two subscales (physical functioning and general health), only the therapeutic climbing group improved while the exercise group did not. This suggests that therapeutic climbing may be equally beneficial as standard exercise training. Comparing both the programs, the benefits of therapeutic climbing significantly exceeded those of the standard exercise training in two of the SF-36 subscales: physical functioning and standard health perception. In the remaining six subscales of the SF-36 and the FFbH-R, therapeutic climbing did not produce improvements that exceed those of a standard exercise training program. Therefore, the application of therapeutic climbing for chronic low back pain may result in improvements of perceived physical functioning and health that are comparable and partly superior to those of a standard exercise program. To our knowledge, this is the first controlled trial evaluating therapeutic climbing for chronic low back pain. It indicates that therapeutic climbing particularly improves perceived health and physical functioning, both of which are of special interest in therapy and rehabilitation of chronic low back pain.

This additional benefit of therapeutic climbing can be explained by characteristics inherent in the training. To fulfill a

TABLE 2. Perceived Physical and Mental Health and Abilities in ADL as Measured by the SF-36 and FFbH-R Before and After 4 Weeks of Training*

		Therapeutic Climbing (N = 10)				Standard Exercise (N = 13)			
		Mean (SD)				Mean (SD)			
Questionnaire	Scale	Before	After	$Z_{(change)}$	$P_{(change)}$	Before	After	$Z_{(change)}$	$P_{(change)}$
SF-36: physical health	Physical functioning	69.50 (15.6)	86.50 (15.1)	−2.814	**0.005**	74.65 (10.0)	75.50 (16.7)	−.595	0.552
	Role limitations (physical)	35.00 (32.9)	60.00 (30.7)	−1.903	0.057	28.08 (33.1)	45.38 (33.1)	−2.041	**0.041**
	Bodily pain	44.80 (16.8)	60.00 (25.7)	−1.887	0.059	37.42 (20.0)	50.06 (25.8)	−1.784	0.074
	General health	59.25 (21.5)	71.10 (13.6)	−2.710	**0.007**	64.13 (15.1)	62.85 (12.4)	−0.455	0.649
SF-36: mental health	Vitality	63.80 (16.0)	76.00 (11.1)	−2.613	**0.009**	53.42 (15.9)	69.77 (12.1)	−2.553	**0.011**
	Social functioning	77.50 (20.5)	87.70 (17.1)	−2.057	**0.040**	62.21 (23.1)	73.85 (28.8)	−2.284	**0.022**
	Role limitations (emotional)	60.00 (32.3)	76.70 (10.4)	−1.473	0.141	41.44 (33.0)	59.46 (29.1)	−1.354	0.176
	Mental health	70.80 (20.7)	83.80 (14.2)	−2.502	**0.012**	58.18 (13.6)	76.23 (14.2)	−2.836	**0.005**
FFbH-R	ADL	66.60 (24.5)	75.40 (22.9)	−.561	0.575	78.77 (16.9)	87.15 (17.2)	−1.202	0.229

**Values are expressed as means (95% confidence interval). Statistical test results are for within groups (before vs. after treatments). The significant values are presented in bold.*
ADL indicates activities of daily living; SF-36, 36-Item Short Form Health Survey; FFbH-R, Hannover Functional Ability Questionnaire for measuring back pain-related disability.

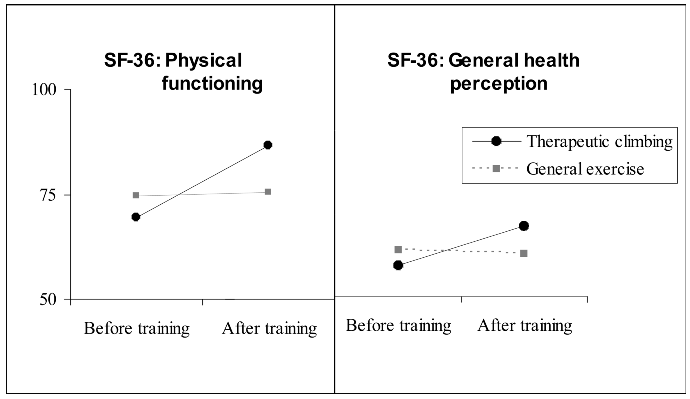

Figure 2. Significantly larger improvements were found for the therapeutic climbing group compared with the general exercise group in two of the eight SF-36 subscales belonging to the physical health cluster: physical functioning and general health perception. Most other subscales of the SF-36 showed improvements for both groups but no difference between groups.

climbing task, patients focus on possible movements, subtle changes in body posture, and associated processes such as balance and breathing. This likely changed their attentional focus from pain and disability to a positive and more capable experience of the body. Patients could make corrections and modify (cognitively and behaviorally) the association between movement, pain, and avoidance behavior. This new experience, in turn, may have led to improvements found in the SF-36.[45,46] This study did not indicate significant changes in ADL as measured by the FFbH-R for the therapeutic climbing or the standard exercise group. This may be due to the high FFbH-R baseline score, which indicated that patients could perform most ADL even though they subjectively experienced physical and mental impairments (as measured by the SF-36). In addition, inpatients were not confronted with several ADL asked in the FFbH-R such as shopping, cleaning, or cooking. A comparison of ADL evaluated in the FFbH-R and the SF-36 (subscales physical functioning and role limitations caused by physical problems) shows that the SF-36 operationalizes ADL in a more general way. Hence, inpatients may have more easily related these items to their actual situation.[47]

No direct measure of improved muscular function was obtained because subjectively perceived health and disability were found to be more valid predictors for successful rehabilitation, often operationalized by return to work, than were physical parameters. Gatchel *et al*[48] found that physically related factors, such as severity of initial low back injury and physical demands of the job, had a low relation to return to work. Instead, psychological factors, such as subjective experience of pain and disability, and psychosocial factors, such as having worker's compensation, discriminate between patients who return to work and those who do not.[49–51] Nevertheless, future research on therapeutic climbing should integrate measures of muscular and psychological improvements to better understand which changes in physiological capability lead to changes in perceived health. It may not be the muscular strengthening *per se* but interplay between coordination and concentration that fosters changes in the experience of physical capabilities.

TABLE 3. Changes in Perceived Health and ADLs for the Therapeutic Climbing Group Compared with the Standard Exercise Group After 4 Weeks of Training*

Questionnaire	Scale	Therapeutic Climbing	Standard Exercise	$Z_{(difference\ of\ change)}$	$P_{(difference\ of\ change)}$
		Change (Mean, SD)	Change (Mean, SD)		
SF-36: physical health	Physical functioning	17.00 (11.8)	00.85 (16.8)	**−2.533**	**0.010**
	Role limitations (physical)	25.00 (33.4)	17.30 (25.8)	−0.471	0.693
	Bodily pain	15.20 (22.8)	12.64 (23.0)	−0.062	0.976
	General health	11.85 (11.6)	−1.29 (11.5)	**−2.342**	**0.018**
SF-36: mental health	Vitality	12.20 (11.8)	16.35 (19.7)	−0.250	0.832
	Social functioning	10.20 (17.5)	11.63 (19.4)	−0.031	0.976
	Role limitations (emotional)	16.73 (36.0)	18.02 (42.4)	−0.363	0.738
	Mental health	13.00 (16.2)	18.05 (16.1)	−1.124	0.284
FFbH-R	ADL	08.80 (41.3)	08.38 (25.2)	0.000	0.506

**Values are expressed as means (95% confidence interval). Statistical test results are for between groups. The significant values are presented in bold.*

ADL indicates activities of daily living; SF-36, 36-Item Short Form Health Survey; FFbH-R, Hannover Functional Ability Questionnaire for measuring back pain-related disability.

This study represents an initial attempt to evaluate the benefits of therapeutic climbing. Results suggest that therapeutic climbing is equally and partly superior to standard exercise therapy. The sample was generally representative of rehabilitation patients; no one had previous experience with climbing and patients were randomly assigned to the climbing group. On the one side, this avoided attracting those with higher self-motivation or an affinity to therapeutic climbing. On the other side, participants were not allowed to choose their preferred sport program, which in turn may have led to a larger dropout in the nonstandard intervention (four of five participants who dropped out due to poor, *i.e.*, less than 30%, participation were in the therapeutic climbing group). Alternatively, the higher drop-out rate in therapeutic climbing may be explained by difficulties of outpatients to align the therapeutic climbing to their private schedule. Due to personal constraints, only four fixed sessions of therapeutic climbing were offered a week. In contrast, patients were able to choose an exercise therapy group according to their personal schedule. Future studies should therefore allow outpatients to adopt training and their private schedule by offering alternative sessions of therapeutic climbing.

Due to constraints in exercise facilities and the therapeutic climbing wall, it was not possible to include more than 14 participants in each group. Future studies should aim at a larger sample size, possibly by including several groups. In addition, this would allow a differential evaluation of inpatients and outpatients or male and female patients. From these results, it is not possible to make predictions about perceived mental and physical health after training and rehabilitation. Follow-up measures should be included in the design of future studies to explore differences in the long-term benefits of therapeutic climbing (*e.g.*, 6 months after rehabilitation).

This study demonstrates that therapeutic climbing may be suitable for patients with chronic low back pain. The therapeutic climbing regime especially improved the perceived health and physical functioning of patients, possibly through changes in attentional focus and new learning experiences regarding movement and pain. This provides physicians with a scientific rationale for recommending it to patients. Further research should investigate the physiological and psychological mechanisms of therapeutic climbing and how patients can maintain the positive experience of physical functioning after rehabilitation. Pragmatic guidelines and manuals for therapeutic climbing need to be developed, including ways in which it can be adapted to other patient populations.

➢ Key Points

- ❑ A randomized controlled clinical trial was performed in patients with chronic low back pain. Two treatments, therapeutic climbing and exercise therapy, were investigated regarding their effect on physical and mental well-being (SF-36) and abilities in ADL (FFbH-R).
- ❑ No difference before *versus* after treatments was found for the FFbH-R. For the SF-36, participants improved in five of the eight subscales (therapeutic climbing) and in four the eight subscales (standard exercise). Comparing both groups, therapeutic climbing resulted in significantly greater improvements in two subscales: physical functioning and general health perception.
- ❑ Therapeutic climbing is suitable for patients with chronic low back pain. Its effects were generally equal to those of exercise therapy. Greater improvements in physical functioning and general health perception may be related to a stronger refocusing from pain to physical capabilities in therapeutic climbing.

References

1. Holbrook T, Grazier K, Kelsey J, et al. *The Frequency of Occurrence, Impact and Cost of Selected Musculoskeletal Conditions in the United States*. Chicago, IL: American Academy of Orthopaedic Surgeons; 1984.
2. Croft PR, Macfarlane GJ, Papageorgiou AC, et al. Outcome of low back pain in general practice: a prospective study. *BMJ* 1998;316:1356–9.
3. Clinical Standards Advisory Group (CSAG). *Back Pain*. London, United Kingdom: HMSO; 1984.
4. Dionne CE. Low back pain. In:Crombie IK, Croft PR, Linton SJ, et al., eds. *Epidemiology of Pain*. Seattle, WA: IASP Press; 1999:283–97.
5. Gatchel RJ, Polatin PB, Mayer TG. The dominant role of psychosocial risk factors in the development of chronic low back pain disability. *Spine (Phila Pa 1976)* 1995;20:2702–9.
6. Hultman G, Nordin M, Saraste H, et al. Body composition, endurance, strength, cross-sectional area, and density of MM erector spinae in men with and without low back pain. *J Spinal Disord* 1993;6:114–23.
7. Goubert L, Crombez G, Peters M. Pain-related fear and avoidance: a conditioning perspective. In: Asmundson GJ, Vlaeyen JW, Crombez G, eds. *Understanding and Treating Fear of Pain*. New York, NY: Oxford University Press; 2004:25–50.
8. Mayer TG, Smith SS, Keeley J, et al. Quantification of lumbar function. Part 2: sagittal plane strength in low back pain patients. *Spine (Phila Pa 1976)* 1985;10:765–72.
9. Nachemson A, Lindh M. Measurement of abdominal and back extension strength with and without low-back pain. *Scand J Rehabil Med* 1969;1:60–5.
10. Roy SH, De Luca CJ, Casavant DA. Lumbar muscle fatigue and chronic lower back pain. *Spine (Phila Pa 1976)* 1989;14:992–1001.
11. Roy SH, De Luca CJ, Emley M, et al. Spectral electromyographic assessment of back muscles in patients with low back pain undergoing rehabilitation. *Spine (Phila Pa 1976)* 1995;20:38–48.
12. Thorstensson A, Arvidson A. Trunk muscle strength and low back pain. *Scand J Rehabil Med* 1982;14:69–75.
13. van Tulder MW, Koes BW, Bouter LM. Conservative treatment of acute and chronic non-specific low back pain: a systematic review of randomized controlled trials of the most common interventions. *Spine (Phila Pa 1976)* 1997;22:2128–56.
14. Taimela S, Diederich C, Hubsch M, et al. The role of physical exercise and inactivity in pain recurrence and absenteeism from work after active outpatient rehabilitation for recurrent or chronic low back pain: a follow-up study. *Spine (Phila Pa 1976)* 2000;25:1809–16.
15. Aure OF, Nilsen JH, Vasseljen O. Manual therapy and exercise therapy in patients with chronic low back pain: a randomized, controlled trial with 1-year follow-up. *Spine (Phila Pa 1976)* 2003;28:525–32.
16. Liddle SD, Baxter GD, Gracey JH. Exercise and chronic low back pain: what works? *Pain* 2004;107:176–90.
17. Hayden JA, van Tulder MW, Malmivaara AV, et al. Meta-analysis: exercise therapy for non-specific low back pain. *Ann Intern Med* 2005;142:765–75.
18. Hayden JA, van Tulder MW, Tomlinson G. Systematic review: strategies for using exercise therapy to improve outcomes in chronic low back pain. *Ann Intern Med* 2005;142:776–85.
19. Barnes PM, Powell-Griner E, McFann K, et al. Complementary and alternative medicine use among adults: United States, 2002. *Adv Data* 2004:1–19.
20. Sherman KJ, Cherkin DC, Erro J, et al. Comparing yoga, exercise, and a self-care book for chronic low back pain: a randomized, controlled trial. *Ann Intern Med* 2005;143:849–56.
21. Morone NE, Greco CM, Weiner DK. Mindfulness meditation for the treatment of chronic low back pain in older adults: a randomized controlled pilot study. *Pain* 2008;134:310–19.
22. Galantino ML, Bzdewka TM, Eissler-Russo JL, et al. The impact of modified Hatha yoga on chronic low back pain: a pilot study. *Altern Ther Health Med* 2004;10:56–9.
23. Williams KA, Petronis J, Smith D, et al. Effect of Iyengar yoga therapy for chronic low back pain. *Pain* 2005;115:107–17.
24. Tekur P, Singphow C, Nagendra HR, et al. Effect of short-term intensive yoga program on pain, functional disability and spinal flexibility in chronic low back pain: a randomized control study. *J Altern Complement Med* 2008;14:637–44.
25. Turner JA. Educational and behavioral interventions for back pain in primary care. *Spine (Phila Pa 1976)* 1996;21:2851–9.
26. Turner JA, Chapman CR. Psychological interventions for chronic pain: a critical review. I. Relaxation training and biofeedback. *Pain* 1982;12:1–21.
27. Turner JA, Chapman CR. Psychological interventions for chronic pain: a critical review. II. Operant conditioning, hypnosis, and cognitive-behavioural therapy. *Pain* 1982;12:23–46.
28. Nicholas MK, Wilson PH, Goyen J. Operant-behavioural and cognitive behavioural treatment for chronic low back pain. *Behav Res Ther* 1991;29:225–38.
29. Kole-Snijders AMJ, Vlaeyen JWS, Goossens MEJB, et al. Chronic low back pain: what does cognitive coping skills training add to operant behavioral treatment? Results of a randomized clinical trial. *J Consult Clin Psychol* 1999;67:931–44.
30. van Tulder MW, Ostelo R, Vlaeyen JWS, et al. Behavioral treatment for chronic low back pain: a systematic review within the framework of the Cochrane Back Review Group. *Spine (Phila Pa 1976)* 2000;20:2688–99.
31. Kern C, Bühlmeyer K, Käser T, et al. Multiple sclerosis and therapeutic climbing: an interventional long term pilot study indicates beneficial effects. In: Hoppeler H, Reilly T, Tsolakidis E, et al, eds. *The Book of Abstracts, 11th Annual Congress of the European College of Sport Science*. Cologne, Germany: Sportverlag Strauss 2006;608.
32. Käser T. Therapeutisches Klettern mit MS [Therapeutic climbing in patients with multiple sclerosis]. *Kontakt* 2006;1:11–12.
33. Lazik D, Bittmann F. Erfahrungsbericht zum therapeutischen Klettern. In: Ohlert H, Beckmann J, eds. *Sport ohne Barrieren*. Schorndorf, Germany: Hoffmann-Verlag; 2002.
34. Schnitzler EE. Letting go in order to move on—clinical report: therapeutic climbing in psychosomatic rehabilitation [In German]. *Rehabilitation* 2009;48:51–8.
35. Heitkamp HC, Mayer F, Boem S. Effekte eines Klettertrainings im Vergleich zu isokinetischem Krafttraining auf die wirbelsäulenstabilisierende Muskulatur [Comparing therapeutic climbing and isokinetic exercise: effects on back extensor muscle force]. *Aktuelle Rheumatologie* 1999;24:40–6.
36. Heitkamp HC, Wörner C, Horstmann T. Klettertraining bei jugendlichen: Erfolge für die wirbelsäulenstabilisierende Muskulatur [Climbing with teenagers: improvements in back extensor muscle force]. *Sportverletzung und Sportschaden* 2005;19:28–32.
37. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). *Med Care* 1992;6:473–83.
38. Bullinger M, Kirchberger I. *SF-36. Fragebogen zum Gesundheitszustand. Handanweisung*. Göttingen, Germany: Hogrefe; 1998.
39. Bullinger M, Kirchberger I, Ware J. Der deutsche SF-36 Health Survey. Übersetzung und psychometrische Testung eines krankheitsübergreifenden Instruments zur Erfassung der gesundheitsbezogenen Lebensqualität [Translation and psychometric testing of a questionnaire on subjectively perceived quality of life].*Zeitschrift für Gesundheitswissenschaften* 1995;3:21–36.
40. Bombardier C. Outcome assessments in the evaluation of treatment of spinal disorders: summary and general recommendations. *Spine (Phila Pa 1976)* 2000;24:3100–3.
41. Kohlmann T, Raspe H. Der Funktionsfragebogen Hannover zur alltagsnahen Diagnostik der Funktionsbeeinträchtigung durch Rückenschmerzen (FFbH-R) [The FFbH-R: a questionnaire assessing functional limitations in patients with musculoskeletal disorders]. *Rehabilitation* 1996;35:1–8.
42. Lurie J. A review of generic health status measures in patients with low back pain. *Spine (Phila Pa 1976)* 2000;25:3125–9.
43. Ware JE. SF-36 health survey update. *Spine (Phila Pa 1976)* 2000;25:3130–9.
44. Iversen MD, Fossel AH, Katz JN. Enhancing function in older adults with chronic low back pain: a pilot study of endurance training. *Arch Phys Med Rehabil* 2003;84:1324–31.

45. Crombez G, Vlaeyen JW, Heuts PH, et al. Pain-related fear is more disabling than pain itself: Evidence on the role of pain-related fear in chronic back pain disability. *Pain* 1999;80:329–39.
46. George SZ, Fritz JM, Bialosky JA, et al. The effect of a fear-avoidance based physical therapy intervention for patients with acute low back pain: Results of a randomized clinical trial. *Spine (Phila Pa 1976)* 2003;28:2551–60.
47. Haase I, Schwarz A, Burger A, et al. Der Funktionsfragebogen Hannover (FFbH) und die Subskala "körperliche Funktionsfähigkeit" aus dem SF-36 im Vergleich [Comparing the FFbH and the SF-36 scale physical functioning]. *Rehabilitation* 2001;40:40–2.
48. Gatchel RJ, Polatin PB, Mayer TG. The dominant role of psychosocial risk factors in the development of chronic low back pain disability. *Spine (Phila Pa 1976)* 1995;24:2702–9.
49. Gatchel RJ, Mayer TG, Eddington A. MMPI disability profile: The least known, most useful screen for psychopathology in chronic occupational spinal disorders. *Spine (Phila Pa 1976)* 2006;31:2973–8.
50. Gatchel RJ, Peng YB, Peters ML, et al. The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychol Bull* 2007;133:581–624.
51. Alaranta H, Rytokoski U, Rissanen A, et al. Intensive physical and psychosocial training program for patients with chronic low back pain: a controlled clinical trial. *Spine* 1994;19:1339–49.