Randomized Trial

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

A Randomized Controlled Study

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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. From demographic, psychosocial, and occupational factors, chronic low back pain has been shown to be strongly related to immobility, muscular impairments, and avoidance behavior. The so-called deconditioning syndrome in low back pain includes impairments in back extensor muscle force, endurance, and spinal mobility. Multiple studies have shown exercise therapy to be an effective treatment to reduce pain-related disability and severity. Stabilization exercises have been shown to significantly improve pain, well-being, and occupational status. Alternative forms of exercise such as yoga have also been successfully applied to chronic low back pain. Tekur et al 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.

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
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Training. These exercises were identical for all patients and consisted of exercises designed for stabilization and trunk muscle training. Occasionally other equipment was 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 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 equipment was 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.

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, mental 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.45,42,43

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).

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

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**TABLE 1. Baseline Characteristics of the Two Treatment Groups**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Therapeutic Climbing</th>
<th>General Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Patients excluded because of &lt;70% participation</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Rate of participation (%)</td>
<td>81</td>
<td>78</td>
</tr>
<tr>
<td>No. of inpatients</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>No. of outpatients</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Age, overall (years)</td>
<td>51.9</td>
<td>50.4</td>
</tr>
<tr>
<td>Sex</td>
<td>6 female, 4 male</td>
<td>6 female, 7 male</td>
</tr>
<tr>
<td>No. of psychotherapy patients</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

*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.

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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. 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 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*

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Scale</th>
<th>Therapeutic Climbing (N = 10)</th>
<th>Standard Exercise (N = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD) Before</td>
<td>After</td>
<td>Z(change)</td>
</tr>
<tr>
<td>SF-36: physical health</td>
<td>Physical functioning</td>
<td>69.50 (15.6)</td>
<td>86.50 (15.1)</td>
</tr>
<tr>
<td></td>
<td>Role limitations (physical)</td>
<td>35.00 (32.9)</td>
<td>60.00 (30.7)</td>
</tr>
<tr>
<td></td>
<td>Bodily pain</td>
<td>44.80 (16.8)</td>
<td>60.00 (25.7)</td>
</tr>
<tr>
<td></td>
<td>General health</td>
<td>59.25 (21.5)</td>
<td>71.10 (13.6)</td>
</tr>
<tr>
<td>SF-36: mental health</td>
<td>Vitality</td>
<td>63.80 (16.0)</td>
<td>76.00 (11.3)</td>
</tr>
<tr>
<td></td>
<td>Social functioning</td>
<td>77.50 (20.5)</td>
<td>87.70 (17.1)</td>
</tr>
<tr>
<td></td>
<td>Role limitations (emotional)</td>
<td>60.00 (32.3)</td>
<td>76.70 (10.4)</td>
</tr>
<tr>
<td></td>
<td>Mental health</td>
<td>70.80 (20.7)</td>
<td>83.80 (14.2)</td>
</tr>
<tr>
<td>FFbH-R</td>
<td>ADL</td>
<td>66.60 (24.5)</td>
<td>75.40 (22.9)</td>
</tr>
</tbody>
</table>

*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.
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 rehabilitated 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 participants who dropped out due to poor, 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


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