

# ORTHOPAEDIC

## Physical Therapy Practice

THE MAGAZINE OF THE  
ORTHOPAEDIC SECTION, APTA



VOL. 22, NO. 1 2010



American Physical Therapy Association  
*The Science of Healing. The Art of Caring.*

# The Effect of Trunk Strengthening on Chronic Low Back Pain: A Systematic Review of the Literature

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## ABSTRACT

**Background:** Chronic low back pain (CLBP) is a significant problem that produces quality of life issues and financial implications. Strengthening exercises are one of many interventions currently used to treat CLBP. However, it is unclear what specific types of strengthening exercises are most effective to address this condition.

**Purpose:** To investigate the effect of various trunk strengthening techniques in treating CLBP. **Methods:** A systematic literature review was conducted. All selected papers were assessed and given a grade for the level of evidence and the strength of the recommendation. **Clinical Relevance:**

Incorporating trunk strengthening into the plan of care for patients with CLBP appears effective in decreasing pain and improving functional levels. General and specific trunk strengthening exercises appeared to be equally effective. The best advice for patients with CLBP is likely to stay active and include some type of trunk exercise as part of a regular fitness program.

**Key Words:** low back pain, core stabilization, strengthening, therapeutic exercise

## INTRODUCTION

Chronic low back pain (CLBP) constitutes one of the greatest factors limiting activity in adults under the age of 45 and is also one of the most expensive ailments to treat.<sup>1</sup> Low back pain is commonly classified as chronic if its duration is longer than 3 months.<sup>2</sup> It is estimated that approximately 10% to 20% of all patients who experience an acute episode of low back pain (LBP) go on to develop CLBP.<sup>3</sup> Nykanen et al<sup>4</sup> reported that patients with CLBP are responsible for 80% of the total cost of treating LBP. In addition, a study by Wheeler<sup>1</sup> in 2007 found that CLBP in the United States accounted for production losses of approximately \$28 billion. Chronic low back pain can persist well beyond 3 months. Approximately 40% of patients with CLBP still ex-

perience pain at 6 months with 33% still reporting pain 1 to 2 years later.<sup>2</sup> Chronic low back pain is a significant problem with major quality of life and financial implications associated with it.

Although there are a variety of interventions used by health care providers in treating CLBP, no one approach has emerged as the most effective. One crucial factor in treating this population may be to identify patients with acute LBP that will go on to develop chronic pain. This identification process may be challenging as most patients with acute onset of low back pain feel better over time and without treatment. According to Lewis et al<sup>2</sup> approximately 70% of patients with acute onset of low back pain improve within one month and 80% to 90% will feel better in 6 weeks without any form of health care intervention.

Unfortunately, there is currently no clear predictive criteria for who will develop CLBP and consequently no specific treatment approach that is known to alleviate this chronic pain. Patients with CLBP receive a wide variety of interventions depending on the health care provider they see for treatment. These nonspecific, and often multifaceted, interventions are a key factor contributing to the escalating costs associated with CLBP.<sup>5</sup>

Some of the frequently used intervention approaches used by physical therapists for CLBP include: trunk strengthening, general exercise, preferential repeated movements, Pilates exercises, group rehabilitation, patient education, manual therapy, modalities, and back school programs. Maher<sup>3</sup> stated that due to the lack of guidance on the best treatment approach for CLBP there are a multitude of exercise programs currently available to patients. Despite the many interventions available to patients with CLBP, the best advice seems to be to increase ones activity level.<sup>3</sup>

There are a variety of ways to increase ones activity level. A common approach

used for CLBP in many physical therapy clinics is trunk strengthening. There is reason to believe that trunk strengthening may decrease pain and improve the function of patients with CLBP in completing their daily activities.<sup>6</sup> Due to the widespread use of trunk strengthening and its purported benefits for patients with CLBP, the purpose of our systematic review of the literature was to investigate the effect of trunk strengthening on CLBP.

## METHODS

### Literature Search

The papers included in this literature review were obtained by searching OVID Medline, CINAHL, Scopus, and Cochrane Database of Systematic Reviews. The following words or combination of words were used to locate papers meeting the inclusion criteria:

Low Back Pain  
Back Pain  
Chronic  
Core Stabilization/Strengthening  
Trunk Stabilization/Strengthening  
AbdominalStabilization/Strengthening  
Therapeutic Exercise  
Interventions  
Physical Therapy  
Outcome Measures  
Spine  
Back School  
Pilates  
Conservative Treatment

The following inclusion and exclusion criteria were used to select papers:

Inclusion criteria:

1. Trunk strengthening was included in the intervention
2. Age group  $\geq$  18 years old
3. Duration of LBP > 3 months
4. Paper in English language

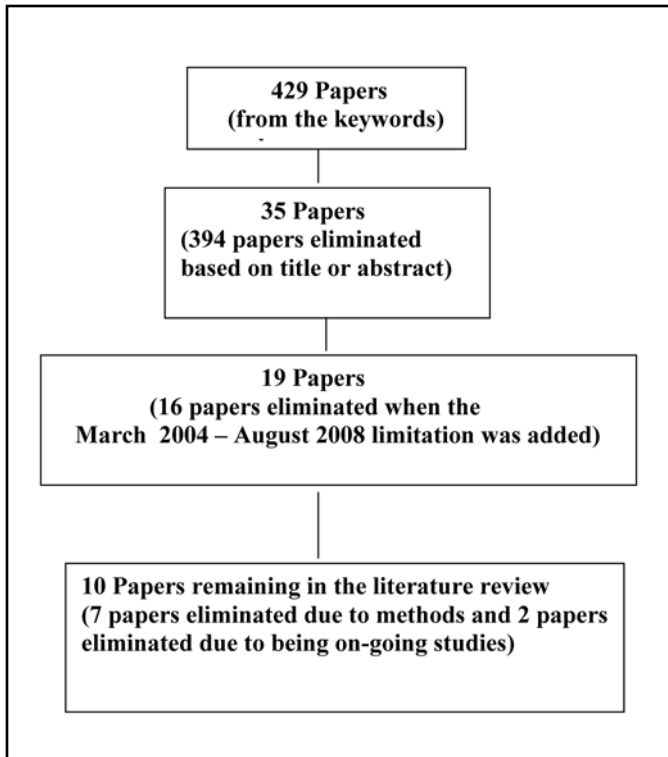
The exclusion criteria were as follows:

1. History of spinal surgery
  2. History of scoliosis requiring bracing
- Originally the search included papers published from 1998 to 2008. During the

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course of the initial search, a literature review by Slade et al<sup>7</sup> was found that included papers describing the effect of trunk strengthening on chronic low back pain in studies through February 2004. After reading this literature review, we limited our search to include only papers published after the Slade et al<sup>7</sup> search and through August 2008 to see if additional studies had been published on the topic. The results of the literature search are illustrated in Figure 1.



**Figure 1. Flow chart of the literature search.**

The literature search began with a keyword search, yielding 429 papers. Next, the titles and abstracts were read and 394 papers were eliminated. Of the 35 remaining papers, 16 papers were removed from the review because they were either included in the literature review by Slade et al<sup>7</sup> or published before March 2004. Lastly, 9 more papers were eliminated after reading the methods section and either did not meet the inclusion/exclusion criteria (7) or were preliminary reports describing on-going studies (2). Finally, 8 RCTs and 2 prospective cohort studies were remaining in our literature search. These 10 papers were reviewed and graded.

### Assessment

All papers were read by each group member. The group then held a meeting for a discussion of each paper. The discussions were led by prearranged primary and

secondary readers from the group. The primary and secondary reader positions were rotated for each paper. The discussion for each paper was guided by the format presented in a chapter entitled, “Evaluating Research Reports” by Portney and Watkins.<sup>8</sup> The group then used the assessment process used by the Philadelphia Panel<sup>9</sup> (see Appendix) to evaluate each paper. Using this assessment, each paper was assigned a grade for the level of evidence and a grade for the strength of the recommendation. Grades were agreed upon by group consensus after a thorough discussion of each paper.

### RESULTS

The literature search yielded 10 papers addressing the effect of trunk strengthening on chronic low back pain. The study designs of these 10 papers included 8 randomized controlled trials and 2 prospective cohort studies.

### DISCUSSION

Ten papers were reviewed. A combined total of 1,369 subjects were treated from 4 to 12 weeks in these papers. A variety of interventions were used in addition to trunk strengthening.

When other interventions were included in a study it made it impossible to discern the effect that trunk strengthening contributed to the patients’ outcomes. Three studies isolated trunk strengthening compared to alternative treatments.<sup>12,13,17</sup> Two studies used Pilates to activate trunk stabilizers compared to control groups.<sup>10,14</sup> The remaining 5 papers used one or more of the following interventions in addition to trunk strengthening: general strengthening, body mechanic training, anatomy education, manual therapy, physical modalities, massage, aquatic therapy, relaxation, group exercises, individual exercises, endurance training, preferential movements, and flexibility exercises.<sup>2,4,11,15,16</sup>

The outcome measures for evaluating patients with CLBP were consistent among most of the studies. The most common tools used were the visual analogue scale (VAS) for pain (0-10),<sup>4,11-13</sup> Roland Morris Disability Questionnaire,<sup>10,12-14,17</sup> Oswestry Low Back

Pain Questionnaire,<sup>4,14,15</sup> and the SF-36 (or part of the instrument).<sup>12,14,17</sup> These outcome measures are well documented for patients with CLBP to be valid and reliable in their assessment of health status, including function, pain, and quality of life.

Overall the strength of the studies reviewed was good with 8 RCTs and 6 of the studies achieving rankings of good evidence (A) to support findings. However, 4 studies did not consistently find trunk strengthening to be the most effective means of treating CLBP as compared to general strengthening, preferential movements, manual therapy, or no treatment.<sup>4,15-17</sup> When manual therapy was performed in the treatment, the outcomes demonstrated no significant difference compared to trunk strengthening.<sup>2,13,16</sup> One study however did have a difference in VAS of pain with the manual therapy group achieving greater pain relief.<sup>12</sup> In 2 studies involving Pilates, improved function was demonstrated with Pilates as compared to general trunk strengthening or a control group.<sup>10,14</sup> The control group in both studies was defined as the use of previously used methods to treat CLBP.<sup>10,14</sup>

Gladwell<sup>14</sup> describes the use of Pilates as the activation of core muscles (transverse abdominis, multifidus, pelvic floor muscles, and diaphragm) with slow progression into more dynamic motions. Pilates trains these muscles submaximally to increase tone and strength of the core muscles. A key difference between Pilates and current trunk stabilization exercises is that Pilates, as stated by Ryneard,<sup>10</sup> increases mind-body awareness, control of movement, and posture. This may have led to better outcomes as functional practice of core stabilizers increases the likelihood of decreasing abnormal muscle recruitment and compensation strategies over time.

Eight studies measured the long-term effects, 12 months or greater, of the groups receiving multiple interventions.<sup>2,10-13,15-17</sup> Two articles demonstrated improvements in outcome measures at the end of treatment, but no significant difference compared to the 12-month follow-up.<sup>13,15</sup> Petersen did not collect immediate results after treatment but demonstrated no differences at 14 months after treatment.<sup>16</sup> Five other articles revealed improvements at the end of treatment that were maintained when follow-up at 12 months was performed.<sup>2,10-12,17</sup> Four articles collected information regarding their postintervention to a 12-month follow-up treatment for CLBP.<sup>2,12,15,16</sup> In the 4 papers that monitored the outcomes after intervention,<sup>2,12,15,16</sup> participants were permitted to engage in

other interventions after completion of the 4 to 12 week study. In all studies, the patients still experiencing pain at the end of the study intervention could pursue additional care to alleviate their CLBP. However, reassessing long term outcomes of patients who have continued self-treatment or saw other health providers for treatment may confound the effects of the studies. We recommend that future studies gather more information regarding care after intervention in order to have more meaningful long term follow-up data.

Another concern when reviewing the 10 papers was the inconsistency in classifying patients with CLBP. Currently, LBP is classified as chronic based on the time frame of symptoms. The Philadelphia Panel<sup>9</sup> classified low back pain into 3 categories: acute, subacute, and chronic. Multiple episodes of LBP can increase the difficulty in making an accurate diagnosis. Also the amount of variance within these broad classifications makes diagnosis and treatment challenging since patients within these broad categories appear to have subgroups. Inadequate classification of patients with LBP likely affects the cost and efficiency in treating these patients. The difficulty in determining the effectiveness of trunk strengthening was increased by this inadequate classification system. For example, 4 studies we reviewed reported including patients with recurrent back pain.<sup>10,11,15,17</sup> Three of the studies admitted patients with multiple episodes of CLBP.<sup>10,11,15</sup> An improved process of classifying LBP should be addressed in future research.

Research has commenced in the area of classifying LBP. Fritz et al<sup>18</sup> in 2003 presented a treatment categorization for patient with LBP. The 4 categories presented were: mobilization, specific exercise, traction, and immobilization. Fritz et al produced evidence supporting a treatment focused classification had better outcomes and was more cost effective in treating acute LBP than a time based approach for classification. This approach to LBP treatment should be studied in patients with CLBP to see if similar results are obtained. A new classification for patients with CLBP may make intervention more specific. For example, perhaps a method could be developed to screen patients to see if they are strengthening responders. Psychosocial factors, such as fear-avoidance beliefs, have also been shown to have an impact on recovery and return to work<sup>19</sup> and therefore also need to be considered in any new classification system. Clearly our current system of classify-

ing patients with CLBP is inadequate.

Cost is always a concern when confronting treatment in health care. Our sample of papers illustrated some of the differences in cost of treatment and the variety of health care systems. Generally, we found the cost of group therapy was less expensive and just as effective as individual treatment. In the United Kingdom, where there is a National Health Service, one study found group treatment generated a 40% savings while producing similar outcomes compared to individual therapy.<sup>2</sup> In a study from Finland with the Finnish Social Insurance Institute financing rehabilitation, Nykanen<sup>4</sup> found that group and individual treatments produced similar results in patients with LBP. Current research appears to support group treatment as effective and efficient and incorporates general strengthening, trunk stabilization, flexibility training, and manual therapy in the treatment of CLBP.<sup>2,4</sup> More research is needed to further examine the benefits of group versus individual treatment.

## CONCLUSION

Current evidence regarding the treatment of chronic low back pain suggests that trunk strengthening is as effective as general strengthening and manual therapy. Upon further investigation there did not appear to be widespread agreement in regards to a specific treatment for chronic low back pain and no gold standard treatment was found. The systematic literature review, including 8 RCTs and 2 cohort studies, produced support that incorporating trunk strengthening into a plan of care is effective in decreasing pain levels and improving functional ability for patients with CLBP. Most studies incorporated many interventions making it impossible to know the exact effect of each intervention. The current classification of patients with CLBP appears to be inadequate to render the most effective and efficient treatment. Also, the use of group therapy versus individual therapy appeared to offer similar benefits but requires further investigation.

## BEST CLINICAL PRACTICE

Based upon our literature review, a plan of care including trunk strengthening ap-

pears to be effective in improving function and decreasing pain in patients with CLBP. The specific method of trunk strengthening, whether it is Pilates, stabilization exercises, or general strengthening does not appear to have a significant effect on the outcomes. Any form of trunk strengthening and activity appears to improve function; however, further research is warranted. Although the use of manual therapy demonstrated similar outcome measures as trunk strengthening, it may not be the most cost effective method to treat CLBP since a skilled clinician is necessary to perform this intervention. For most patients the best advice may be to become more active on a daily basis and incorporate a nonspecific trunk strengthening program as part of a daily lifestyle.

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**Appendix<sup>9</sup>**

Data Sheet

Intervention: \_\_\_\_\_

Title: \_\_\_\_\_

Author: \_\_\_\_\_

Was subject selection randomized? YES NO

Was there a control group? YES NO

Total number of subjects: \_\_\_\_\_

Subject Description: \_\_\_\_\_

Outcomes Used: \_\_\_\_\_

Grading of Evidence (circle one) I II – III – 2 II – 3 III

Grading of Evidence	
I	Evidence from at least 1 properly randomized controlled trial (RCT)
II – 1	Evidence from well-designed controlled trials without randomization
II – 2	Evidence from well-designed cohort or case-control analytic studies, preferably from more than 1 center or research group
II – 3	Evidence from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments could also be included here.
III	Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees
Grading of Recommendations	
A	Good Evidence to support the recommendation that the intervention be specifically considered
B	Fair Evidence to support the recommendation that the intervention be specifically considered
C	Poor evidence regarding inclusion or exclusion of a intervention, but recommendations may be made on other grounds