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Effective physical treatment for chronic low back pain

C.G. Maher, PhD, PT

School of Physiotherapy, Faculty of Health Sciences, The University of Sydney, P.O. Box 170, Lidcombe, New South Wales 1825, Australia

The problem of chronic low back pain

Low back pain (LBP) is the main cause of absenteeism and disability in industrialized societies. Approximately 10%–20% of patients with LBP develop chronic LBP, defined as pain and disability persisting for more than 3 months. Chronic LBP is a major health problem with enormous economic and social costs. These patients use more than 80% of all healthcare costs for back trouble, and treatment for this group has a low success rate [1]. Unfortunately chronic LBP is prevalent in many countries around the world (eg, the Australian 2001 National Health Survey reported that 21% of Australians had long-term back problems) [2].

The Cochrane reviews that have evaluated treatments for chronic LBP explain why chronic LBP is frustrating for clinicians and patients. Commonly prescribed treatments such as acupuncture [3], transcutaneous electrical nerve stimulation (TENS) [4], injection therapy [5], nonsteroidal anti-inflammatory drugs [6], and lumbar supports [7] have no evidence to support their use.

There is obviously a need to establish objectively the efficacy of treatments for chronic LBP and to disseminate this information to healthcare providers and patients. This article considers the efficacy of physical treatments for chronic LBP. Surgical, drug, or psychologic treatment options are not considered.

Judging treatment efficacy

The best evidence about the effectiveness of therapy is provided by well designed systematic reviews and randomized controlled trials (RCTs). Theoretically these study types provide unbiased estimates of the effects of therapy. More recently there is some empiric evidence that lower levels of evidence (eg, studies with historical controls) and poorly conducted randomized controlled trials tend to produce inflated estimates of the size of treatment effects [8–11]. Because lower quality evidence produces misleadingly optimistic estimates of treatment effectiveness, this article only considers systematic reviews and randomized controlled trials when describing the effects of physical treatment for chronic LBP.

In recent years there has been an enormous increase in the volume and accessibility of high quality evidence on physical treatment for LBP. One measure of the growth of evidence is that the Physiotherapy Evidence Database (PEDro; http://www.pedro.fhs.usyd.edu.au/) now contains 408 randomized controlled trials (RCTs) and 91 systematic reviews on physical treatment of LBP (based on a search of PEDro conducted on July 9, 2003). There is now sufficient evidence to permit an evidence-based, rather than an anecdote-based, approach to physical treatment for LBP.

In this review the term "physical treatment" is used in preference to the term "physical therapy" to avoid ambiguity. When the term "physical therapy" is used, confusion can arise with statements such as "Physical therapy is ineffective for this condition," because it is unclear whether the investigator meant that all treatments provided by a physical therapist are ineffective for the condition (unlikely but possible) or that a specific physical therapy treatment is ineffective (more likely). Even when it is clear that the investigator is referring to a treatment and not a profession, it would be more helpful to name the ineffective treatment so that one could avoid prescribing or administering this

E-mail address: C.Maher@fhs.usyd.edu.au

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treatment. Additionally most physical treatments are provided by a range of professions, not just by physical therapists, and because the typical treatment provider for a treatment varies from country to country it is simpler to avoid reference to any profession.

Effective physical treatments for chronic low back pain

Exercise

Exercise is one of the few clearly effective treatments for chronic LBP. The four most recent systematic reviews of exercise have each concluded that exercise is an effective therapy for chronic LBP [12–15]. Also, the effect of exercise seems sufficiently large and durable to be clinically important. As an illustration, in Kankaanpaa et al's RCT [16] at 12-month follow-up, the subjects who undertook the exercise program had on average halved their pain and disability, whereas those who received the control treatment of massage did not change from baseline. O'Sullivan et al's RCT [17] found similarly large improvements in pain and disability that were maintained at 30-month follow-up. For example, the exercise group had an average pain score of 59/100 at baseline that reduced to 23/100 at 30 months, whereas the group who were managed by their general practitioner had no meaningful reduction in their pain (baseline score: 53/100, 30-month follow-up score: 52/100).

Although exercise is one of the few evidence-based treatments for chronic LBP, the optimal way to implement this treatment is unknown. Maher et al's [12] systematic review located a limited number of head-to-head comparisons of various exercise programs. The review concluded there was evidence that the intensity (intensive programs were more effective than gentle programs), the provision of supervision (supervised programs were more effective than unsupervised), and the inclusion of principles of cognitive-behavioral treatment all influenced treatment efficacy.

Because of uncertainty about the best way to prescribe exercise, an enormous variety of exercise programs currently are offered to patients. Exercise programs for chronic LBP vary in the type of exercise prescribed (eg, land-based exercise versus exercise in water) and the dose of exercise administered (eg, intensity and duration of exercise program). To illustrate the range, the author describes two approaches to exercise that we currently are evaluating in an RCT: group general exercise and individually supervised specific spinal stabilization exercise. Both are known to be effective, but it is unclear whether one is more effective than the other.

The general exercise program is modeled on the Back to Fitness program [18], with patients treated in groups of up to eight patients. At session 1, patients receive an individual preprogram assessment to familiarize them with the program, set treatment goals, and set the initial intensity level for each exercise. The patient is reassured that they have no serious cause for their back pain and that the exercise program is safe and effective. Daily exercise/physical activity at home is encouraged and monitored to enhance compliance. Written and illustrated exercise instructions are provided also. Sessions 2–11 are each 1 hour general exercise sessions consisting of (1) warm up and stretching, (2) exercise stations with different degrees of difficulty, (3) cool down, (4) tip for the day, and (5) a relaxation session. Principles underlying cognitive-behavioral therapy also are used by the physiotherapists in their training and supervisory roles. These principles include the encouragement of skill acquisition by modeling, the use of pacing, shaping, setting progressive goals, self-monitoring of progress, and verbal positive reinforcement of progress. Session 12 concludes the exercise program, with subjects attending an individual discharge session in which their efforts are reinforced and improvements in activity levels noted. A plan is developed jointly by physiotherapist and patient to increase and maintain activity levels.

The specific spinal stabilization exercise program is based on the treatment approach reported by O'Sullivan et al [17], Richardson et al [19], and Goldby et al [20], with patients treated individually. At session 1, patients receive an individual preprogram assessment and then are prescribed exercises aimed at improving function of specific muscles of the low back region to be conducted in sessions 2–11. The most commonly prescribed exercises include those aimed at retraining multifidus (a back muscle) and transversus abdominus (a deep abdominal muscle); these are supplemented with exercises for the pelvic floor and breathing control. Patients are taught how to contract these muscles independently from the superficial trunk muscles [19,21], and therapists use real-time ultrasound to provide feedback to the patient. Once patients are able to perform these exercises, the complexity of tasks is increased and patients progress through a range of functional tasks and exercises targeting coordination of trunk and limb movement. Patients require the ongoing support of a well trained physiotherapist to ensure correct performance of specific spinal stabilization exercise. Principles underlying cognitive-behavioral therapy, such as education, biofeedback,

reinforcement, and shaping also are used with the specific spinal stabilization approach. Session 12 is an individual discharge session analogous to the session offered in the general exercise program.

Exercise is one of the few treatments for chronic LBP that has been shown to have a large treatment effect in the short and long term. At present the optimal way to implement this treatment is unknown and consequently an enormous variety of exercise programs currently are offered to patients.

Laser

Laser therapy is the application of low level laser light to the skin surface. The treatment may be used alone or in combination with other treatments for LBP. Patients typically attend a clinic for a course of laser therapy. A course of 12 sessions of laser would cost approximately AUS $600.

No systematic review has evaluated the efficacy of laser for chronic LBP. Four RCTs of laser therapy [22–25] were archived on PEDro on May 27, 2003. The four RCTs were all double blinded and of high methodologic quality; however, none provided long-term follow-up. The longest follow-up was 1 month after cessation of the 1-month course of treatment [24]. Three studies provided sufficient data to allow pooling [22,24,25]. The pooled effect of active laser compared with placebo laser is a 0.8 unit (95% CI; 1.5–0.0) greater reduction in pain on a 0–10 pain scale [1]. The typical patient with chronic pain would not regard a change of this magnitude as clinically meaningful [26]. Although laser therapy reduces pain in the short term, the effect seems too small to be clinically worthwhile. The long-term effects of laser are unknown.

Massage

The use of massage for the treatment of LBP is popular and has a long history of use across a range of cultures. There are many styles of massage and massage may be provided as a stand-alone treatment or as part of a treatment package. A typical treatment course for a chronic LBP patient might entail weekly sessions for 2 months and this would cost approximately AUS $400.

There are five systematic reviews on massage for chronic LBP [13,15,27–29]. Three reviews concluded that it is unknown whether massage is effective; the Cochrane review [29] cautiously suggested massage might be beneficial, whereas the most recent review [27] was definite in proclaiming massage to be effective. The conclusion of the latest review, however [27], may be overly optimistic for a number of reasons. First, the review ignored the results of earlier trials with generally negative results and instead focused on three recent positive massage trials, a strategy that biases seriously the results of a review. Second, there was no consideration of the magnitude or durability of the pain-relieving effect. The magnitude of the effect of massage in the Cherkin et al trial [30] was small: at best 1 point on a 10-point pain scale, and patients with chronic pain typically would regard this as unchanged or minimally improved [26]. More important, the effects were transient. For example, Cherkin et al's trial [30] found that the pain-relieving effect of massage did not persist beyond the 10-week treatment phase and in Hernandez-Reif's trial [31], pain relief was not even maintained between treatment sessions. Although some massage trials have reported massage to be effective, the benefits reported are minor and transient and these characteristics limit its value as a therapy for chronic LBP.

Multidisciplinary rehabilitation

Although multidisciplinary rehabilitation clearly implies the involvement of several health professionals in the treatment program for a patient with chronic LBP, the more important issue is that this approach requires assessment and management of physical, psychologic, and social/occupational factors associated with LBP. This comprehensive approach to LBP management is based on a biopsychosocial model of illness. Programs vary widely; however, the usual program is brief and intensive (eg, 3 weeks at 39 hours per week) [32] and so the programs cost many thousands of dollars. Most programs include a graded physical activity program that incorporates exercise within therapy sessions, a home program of exercise, and a graded increase in home and work functional tasks.

The Cochrane review [33,34] on this topic located 12 trials and concluded that intensive multidisciplinary rehabilitation with functional restoration is more effective in improving pain and function than outpatient nonmultidisciplinary rehabilitation. This conclusion does not consider the size of the treatment effect, which were only modest for pain and function. For example, in Bendix et al's study [32], at 4-month follow-up the median scores in the experimental group were 5.7/10 for pain and 12.1/30 for disability versus 6.9/10 and 16.8/30 in the untreated control group. More impressive was the difference in median number of sick leave days: 10 in the treatment group versus 122 in the no-treatment group.

Although multidisciplinary treatment is effective, the high cost means that these programs should be

reserved for patients who do not respond to cheaper treatment options for chronic LBP.

Spinal manipulation

The term "spinal manipulation therapy" (SMT) includes the use of high velocity thrust techniques and also low velocity mobilization techniques. Typically a patient would receive a mixture of both techniques in a treatment program. A course of treatment might entail eight treatments over a month at a cost of AUS $500.

There are a large number of reviews of SMT and they have come to conflicting conclusions. The two most recent meta-analytic reviews [35,36] provide the best evidence on the effects of manipulation for chronic spinal pain because they include more trials, the reviews were of higher quality, and they provide an estimate of the size of the treatment effect.

Ferreira et al's review [36] concluded that, although SMT was more effective than placebo, the pooled effect size for pain reduction at 1 month was probably too small to be clinically worthwhile: 7 mm (95% CI; 1–14) on a 100-mm visual analog scale (VAS). Assendelft et al's estimate of the short-term effect was similar at 10 mm (95% CI; 3–17); however, the long-term effect was larger at 19 mm (95% CI; 3–35) and this effect size is probably clinically worthwhile. Assendelft et al also compared SMT to other active therapies and found that there were no statistically significant or meaningful differences in favor of manipulation. Although recent reviews have concluded that SMT is an effective treatment for chronic LBP, the effect seems small and this characteristic needs to be considered when prescribing this treatment.

Ineffective treatments

Hydrotherapy

Hydrotherapy or exercise in water has a long history of use as a treatment for musculoskeletal conditions. A typical program for a patient with chronic LBP might be eight 1-hour sessions over a month [37].

There are two RCTs that have evaluated hydrotherapy for chronic LBP, both finding no difference between hydrotherapy and the control treatment. McIlveen and Robertson's study [37] found that subjects randomized to a 1-month program of hydrotherapy had no better outcomes at 1 month follow-up than those randomized to a waiting list. The hydrotherapy program provided no benefit in pain, disability, or lumbar range of motion. Sjogren et al's study [38] compared group hydrotherapy to a vaguely described land-based treatment program. Subjects were assessed at baseline, after a no-treatment run-in period, and then after 1 month of therapy. The investigators reported that there were no significant differences (for pain, disability, and walking speed) between the two types of treatment, and so concluded that both treatments were equally effective. It is also possible, however, to have no between-group differences where both treatments are equally ineffective. Inspection of the within-group differences suggests that this was the case: the changes in pain and disability were trivially small and of the same magnitude observed in the no-treatment run-in period.

Based on the results of the two RCTs completed to date, hydrotherapy seems to be an ineffective treatment for chronic LBP.

Magnets

Magnets have been widely promoted recently as a means to relieve pain. To allow the magnet to be used for extended periods, the magnet can be incorporated into an adhesive dressing, jewelry, a brace/orthosis, or a pillow or mattress cover. The cost varies substantially.

There are no systematic reviews of magnets for chronic LBP. The one available RCT [39] was of high quality and demonstrated clearly that real and sham magnets had equally small effects in reducing pain. The mean reduction in pain in the active magnet group was 0.5 cm on a 10-cm VAS scale versus 0.4 cm in the sham group. The between-groups difference was 0.1 cm (95% CI; 1.0–1.1). Accordingly, at this stage the available evidence suggests that magnets are of no clinical benefit in patients with chronic LBP.

Transcutaneous electrical nerve stimulators

Transcutaneous electrical nerve stimulators (TENS) pass electrical currents through the body by way of surface electrodes to provide analgesia. The units are small and portable and so can be used while a patient undertakes work or home duties. Chronic LBP patients would typically purchase a unit at an approximate cost of AUS $200.

The four systematic reviews of TENS have concluded that either TENS does not have a clinically important effect [4,13,40] or is of unknown value [15,41] in the treatment of chronic LBP. For example, Brosseau et al's [40] pooled estimate of the effect of active versus placebo laser was a 4.3 mm (95% CI; 1.7–10.4 mm) greater pain reduction on a 100-mm VAS in the active treatment group. The effect was not statistically or clinically significant.

Traction

Traction involves the stretching of the spine to induce vertebral separation. Traction usually is administered in a clinic with a motorized traction bed; the upper body is fixated with a thoracic harness and then forces are applied by way of a pelvic halter. Traction may be delivered as a stand-alone therapy or in combination with electrotherapies. A course of treatment might include 12 sessions in 1 month at an approximate cost of AUS $600.

There are five systematic reviews on traction. The two most recent have concluded that traction is ineffective [13,42], whereas the earlier reviews concluded that traction was of unknown value [41,43,44]. The Philadelphia Panel review [13] undertook a meta-analysis of the two trials that compared active traction to sham traction and found slightly larger pain reduction in the group receiving the sham traction: −6.3 mm (95% CI; −15.8 to −3.1) on a 100-mm VAS pain scale. The available evidence suggests that traction is not an effective treatment for chronic LBP.

Ultrasound

Therapeutic ultrasound within the intensity range 0.1–2.5 W/cm^2 is used widely in the treatment of musculoskeletal conditions. The treatment can be delivered as a single treatment or more commonly as an adjunct to other physical treatments. When delivered as a single treatment, a typical course might entail 12 sessions over 1 month at an approximate cost of AUS $600.

The only systematic review of ultrasound in the treatment of chronic LBP concluded that ultrasound is ineffective [13].

Treatments of unknown value

Acupuncture

Acupuncture involves the insertion of needles into precise points on the skin surface. The needles may be stimulated manually or with electricity, and the acupuncture treatment may be combined with moxibustion and cupping. A typical course of treatment may involve eight sessions at a cost of approximately AUS $400.

The Cochrane review [45] and three other systematic reviews [27,46,47] have each concluded that there is no convincing scientific evidence that acupuncture is an effective treatment for chronic LBP. Accordingly, at this stage the fairest assessment would be that acupuncture remains of unknown value in the treatment of chronic LBP.

Back schools

The content of back schools seems to vary widely, but the common element is the inclusion of group education and exercise. The curriculum taught, the exercises performed, and the duration of the programs are not standardized.

Three systematic reviews of back schools by the same research group have concluded that the treatment is effective for chronic LBP [41,48,49]. Unfortunately each review synthesized the results of individual trials using the levels of evidence approach and, recently it has been shown that this method is sensitive to the specific rules used for pooling. For example, although the Cochrane review [48] concluded that "there is moderate evidence that back schools provide better short term effects than other treatments for chronic LBP," Ferreira et al's reanalysis of the Cochrane data set using three other sets of levels of evidence criteria produced three different conclusions on the efficacy of back schools: weak evidence, limited evidence, and no evidence [50]. Accordingly, there is some doubt about the efficacy of back schools.

Lumbar supports

There are two systematic reviews of lumbar supports for chronic LBP. The Cochrane review [7,51] and an earlier review by Koes et al [52] concluded that lumbar supports are of unknown value in the treatment of chronic LBP.

Miscellaneous unevaluated treatments

Although it is common practice to make suggestions about the correct mattress/bed for patients with LBP, there are no clinical trials evaluating the effect of various mattresses/beds for patients with chronic LBP. Other common treatments, such as Pilates therapy, Feldenkrais therapy, Alexander technique, and craniosacral therapy also are yet to be evaluated for the treatment of chronic LBP.

Summary

It is now feasible to adopt an evidence-based approach when providing physical treatment for patients with chronic LBP. A summary of the efficacy of a range of physical treatments is provided in Table 1.

Table 1
Summary of efficacy of physical treatments for chronic LBP

	Conclusion on efficacy			
Treatment	Effective: large/durable effect	Effective: small or transient effect	Ineffective	Unknown efficacy
Exercise	+			
Laser		+		
Massage		+		
Spinal manipulation		+		
Multidisciplinary rehabilitation	+			
Hydrotherapy			+	
Magnets			+	
TENS			+	
Traction			+	
Ultrasound			+	
Acupuncture				+
Back schools				+
Lumbar supports				+
Pilates				+
Beds/mattresses				+
Feldenkrais				+
Alexander technique				+
Craniosacral therapy				+

The evidence-based primary care options are exercise, laser, massage, and spinal manipulation; however, the latter three have small or transient effects that limit their value as therapies for chronic LBP. In contrast, exercise produces large reductions in pain and disability, a feature that suggests that exercise should play a major role in the management of chronic LBP. Physical treatments, such as acupuncture, back school, hydrotherapy, lumbar supports, magnets, TENS, traction, ultrasound, Pilates therapy, Feldenkrais therapy, Alexander technique, and craniosacral therapy are either of unknown value or ineffective and so should not be considered. Outside of primary care, multidisciplinary treatment or functional restoration is effective; however, the high cost probably means that these programs should be reserved for patients who do not respond to cheaper treatment options for chronic LBP.

Although there are now effective treatment options for chronic LBP, it needs to be acknowledged that the problem of chronic LBP is far from solved. Though treatments can provide marked improvements in the patient's condition, the available evidence suggests that the typical chronic LBP patient is left with some residual pain and disability. Developing new, more powerful treatments and refining the current group of known effective treatments is the challenge for the future.

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