

Effects of spinal manipulation versus therapeutic exercise on adults with chronic low back pain: a literature review

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Background Context: *Chronic low back pain (CLBP) is a prevalent disorder that has a significant burden to society in terms of loss of work time and increased economic cost. Two common treatment choices of intervention for CLBP are spinal manipulation and prescribed exercise.*

Purpose: *The purpose of this systematic review was to examine the effectiveness of spinal manipulation vs prescribed exercise for patients diagnosed with CLBP. Studies that compared head-to-head spinal manipulation to an exercise group were included in this review.*

Methods: *A search of the current literature was conducted using a keyword process in CINAHL, Cochrane Register of Controlled Trials Database, Medline, and Embase. The search was conducted on, and included studies available up to August 29th 2014. Studies were included based on PICOS criteria 1) individuals with CLBP defined as lasting 12 weeks or longer; 2) spinal manipulation performed by a health care practitioner; 3) prescribed exercise for the treatment of CLBP and monitored by a health*

Historique : *La lombalgie chronique est un trouble fréquent qui devient un lourd fardeau pour la société, en perte de temps au travail et en augmentation du coût économique. La manipulation vertébrale et la prescription d'exercices représentent deux choix de traitement courants pour la lombalgie chronique.*

Objectif : *Le but de cette analyse systématique était d'examiner l'efficacité des manipulations vertébrales par rapport aux exercices pour les patients atteints de lombalgie chronique. Les études qui ont comparé directement la manipulation vertébrale à un groupe suivant des exercices ont été intégrées dans cette analyse.*

Méthodologie : *Une recherche des publications scientifiques actuelles a été réalisée en utilisant un procédé de mots-clés dans CINAHL, Register of Controlled Trials Database, Medline et Embase. La recherche a été effectuée le 29 août 2014 et a englobé les études disponibles jusqu'alors. Les études ont été incluses en fonction des critères PICOS 1) personnes souffrant de lombalgie chronique, définie comme subsistant 12 semaines ou plus; 2) manipulations vertébrales effectuées par un professionnel de la santé; 3) prescription d'exercices pour le traitement de la lombalgie chronique et suivi par un professionnel de la santé; 4) résultats cliniques mesurables pour réduire*

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care practitioner; 4) measurable clinical outcomes for reducing pain, disability or improving function; 5) randomized controlled trials. The quality of included articles was determined by the author using the criteria developed and used by the Physiotherapy Evidence Database (PEDro).

Results: Three randomized controlled trials met the inclusion criteria of this systematic review and were included in this review. The outcomes used in these studies included Disability Indexes, Pain Scales and function improvement scales. The results included a mix of effects with one study finding spinal manipulation as more effective and another finding the exercises more so. The third study found both interventions offering equal effects in the long term.

Conclusion: Based on the findings of this systematic review there is no conclusive evidence that clearly favours spinal manipulation or exercise as more effective in treatment of CLBP. More studies are needed to further explore which intervention is more effective.

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KEY WORDS: back pain, chronic, spinal manipulation, exercise, chiropractic

Introduction

Chronic low back pain (CLBP), defined as pain lasting 3 months or more, is a major cause of disability in industrialized societies and more than 80% of the health care resources for back pain are utilized on these patients.^{1,2,3} CLBP can arise from a variety of anatomical structures or can be part of an array of pathologies of the spine and therefore require different treatments depending on its cause.⁴ It is estimated that 80-90% of patients are diagnosed with low back pain arising from non-specific mechanical reasons.^{4,5} Most patients suffering with CLBP are treated non-operatively with a variety of conservative treatments.⁴

The rehabilitation health care professionals treating CLBP patients often employ a variety of modalities in-

cluding therapeutic exercise and spinal manipulation.^{4,6,7} Some studies have found that the treatment of CLBP with spinal manipulative therapy may significantly decrease pain and improve function.^{4,6,7} Therapeutic exercise has also been shown to provide improvement on pain and functioning.^{4,6} There have been many studies assessing the benefits of either treatment on patients with CLBP, however the majority of these studies have focused on investigating each treatment on their own. There are significantly fewer studies that have investigated and compared both treatments head-to-head in the treatment of CLBP.

Résultats : Trois essais cliniques randomisés répondaient aux critères d'admissibilité à cette analyse systématique et donc ont été inclus dans cette analyse. Les résultats utilisés dans ces études comprenaient des indices d'invalidité, des échelles de la douleur et des échelles d'amélioration de la fonction. Les résultats comprenaient un mélange d'effets, une étude montrant l'efficacité supérieure de la manipulation vertébrale alors qu'une autre concluait que les exercices étaient plus efficaces. La troisième étude a conclu que les deux interventions offraient les mêmes effets à long terme.

Conclusion : En fonction des résultats de cette analyse systématique, on ne peut pas déduire de façon concluante et claire si la manipulation vertébrale ou les exercices sont plus efficaces dans le traitement de la lombalgie chronique. Il faut mener d'autres études pour explorer davantage laquelle des interventions est plus efficace.

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MOTS CLÉS : lombalgie, chronique, manipulation vertébrale, exercice, chiropratique

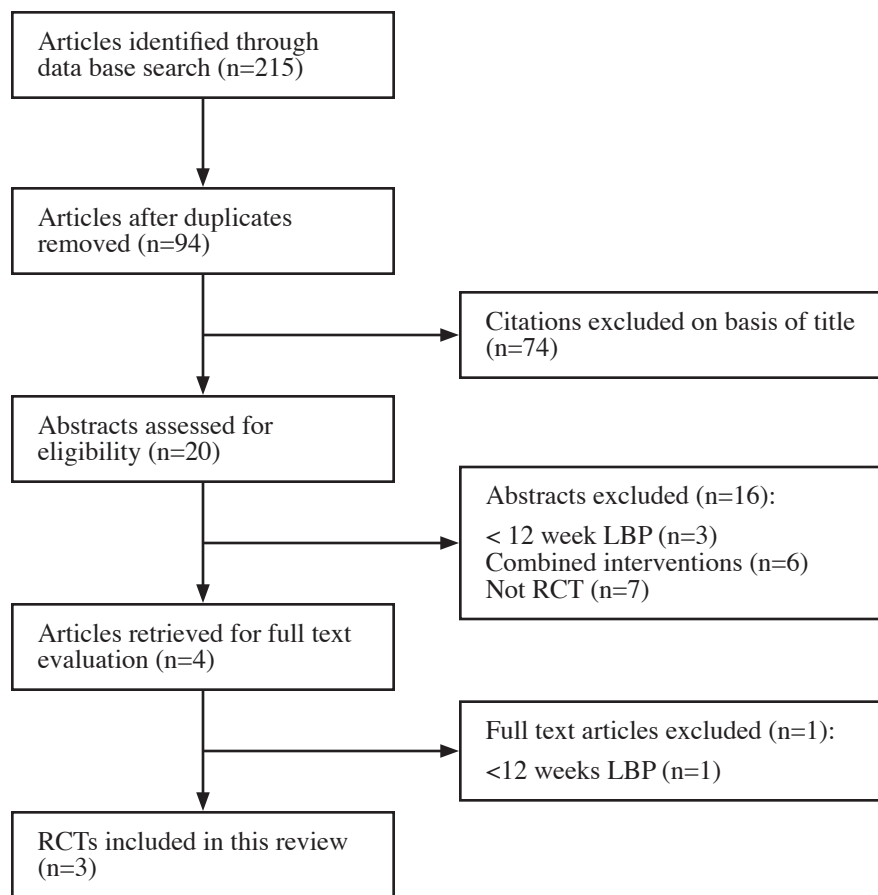


Figure 1.
Study flow diagram

nipulation and exercise in treating CLBP.⁸ However, that systematic review defined CLBP as 6 weeks or more in duration whereas in the current review it is defined as 12 weeks or more in duration.

Spinal manipulation and exercise are important modalities that play a central role in the treatment of CLBP.⁹ This paper aims to summarize the available research evidence comparing the effects of spinal manipulation and therapeutic exercise [on disability or pain] related to chronic low back pain in adults.

Methods

Study Design

The author used Preferred Reporting Items for System-

atic Reviews and Meta-analysis (PRISMA).¹⁰ PRISMA can be used to report systematic reviews of various forms of research but is most appropriate for randomized controlled trials.¹⁰

Eligibility Criteria

Decisions for inclusion of published studies were based on the following Population, Intervention, Control, Outcomes, and Study design (PICOS) criteria¹¹ defined for this systematic review as:

Inclusion criteria:

Patients: human adult participants (18 years of age or older) with low back pain persisting 12 weeks or longer.

Intervention: spinal manipulative therapy, defined as high velocity and low amplitude thrust and/or manual

mobilization of vertebral joints, must be performed by a health care practitioner (chiropractor, physiotherapist or other manual health care practitioner).

Comparison: exercise must be prescribed specifically for the treatment of CLBP and monitored by a health care professional.

Outcome: pain, disability or quality of life scores, not limited to one specific measure. No restriction on length of follow up.

Study Design: published randomized controlled trials

Additional inclusion criteria: Studies must be published and in the English Language (due to limited resources to translate from other languages). The search was not restricted by publication date to avoid exclusion of relevant studies.

Exclusion criteria:

- Studies that used CLBP subjects diagnosed with spinal stenosis, spondylolisthesis (2nd degree or more), lumbar scoliosis (>20° or more), previous vertebral fractures, systemic causes of CLBP (rheumatoid arthritis), psychiatric or cognitive co-morbidities.
- Studies that used CLBP patients diagnosed with specific spinal pathologies including malignancies, inflammatory joint disease and bone disease and/or disc prolapsed or herniations with or without neurological compromise.

Search Strategy

A keyword search in CINAHL, Cochrane Register of Controlled Trials Database, Medline, and Embase was conducted on August 29th 2014. The keywords used were manipulation, exercise, and chronic low back pain. The search was completed by combining the keywords with AND. Limits applied were human and English language.

In addition to the above primary database search, the reference lists of included studies and systematic reviews of similar topics were screened for relevant studies that were not produced by the database search.^{8,12} This was done to ensure that no relevant study was missed in the search.

Study Selection

The review process was completed systematically as follows 1) title search, 2) abstract search, and 3) full text search for relevance. The reason for excluding articles at step 2 and 3 are described.

Risk of Bias

Each of the included articles was reviewed by the author and scored with the Physiotherapy Evidence Database (PEDro) quality assessment tool.¹³ This retrospective quality assessment tool was designed to evaluate the internal validity and statistical reporting of randomized controlled trials. The PEDro scale consists of 11 items that pertain to the quality of RCTs. The highest score of 11/11 represents the highest possible quality and the lowest risk of bias whereas 0/11 is the lowest possible quality.

Results

Risk of Bias Within Studies

Risk of bias within the individual studies was assessed using the PEDro scale and results are as follows. One study scored 9/11¹⁴, the second study scored 8/11⁹, and the third study scored 9/11¹⁵. None of the three studies met criteria five and six (blinding of all the subjects and of all therapists administering therapy respectively).

One study¹⁵ carried a participant selection bias risk. All of the participants were recruited through public hospitals, were unemployed and from low socioeconomic status. Studies show that CLBP patients from low socioeconomic status may be harder to treat.¹⁶ This may put the external validity of the study to the general population into question.

Another study⁹ may have a participant selection bias. All the participants were recruited at a public national health service at their physiotherapy department. These participants were all referred to this department and had not sought other choices such as private care or other health care practitioners that provide spinal manipulation such as chiropractors, osteopaths, or other practitioners trained in spinal manipulation. Thus, the external validity of the results might be questionable.

Risk of Bias for all Studies

The main bias in all the studies is that reporting of the outcome by subjects is done in a self-report and subjective manner. Recollection and self-reporting of data from subjects inevitably carries the risk of self-report bias and possible inaccurate outcomes. Furthermore, the design of all studies did not account for possible spontaneous recovery of CLBP by the subjects under either intervention.

A total of three relevant studies were located and cat-

Table 1.
Characteristics of Individual Studies

Author (year)	Participant Details	Intervention Investigated [details]	Comparison Intervention [details]	Outcome Measures	Findings
(Cecchi et al. 2012)	n= 210 ages 59±14 Inclusion: >6 months Non-specific LBP Exclusion: Neurological signs or symptoms, spondylolisthesis >2nd degree, spinal stenosis, lumbar scoliosis >20 degrees, rheumatoid arthritis or spondylitis, previous vertebral fracture, psychiatric disease, cognitive impairment, or pain-related litigation	Spinal manipulation [Mobilization and manipulation (patient specific) of spine, and soft tissue manipulation. 4-6 treatments (as needed) weekly, 20 minute sessions, 4-6 weeks of treatment.]	Back school [education, relaxation techniques, postural and individually tailored back exercises. 15x 1h sessions, 5 days per week, 3 weeks] Individual physiotherapy [Mobilization, active exercise, massage, PNF, education. 15 x 1h sessions, 5 days per week, 3 weeks.]	Roland Morris Disability Questionnaire (RMDQ) (scoring 0-24) Pain Rating Scale (scoring 0-6)	Spinal manipulation showed the highest functional improvements when compared with BS and IP.
(Ferreira et al. 2007)	n=240 Inclusion: >3 months Non-specific LBP Ages 18-80 yrs Exclusion: Serious pathology, neurological signs, malignancy, inflammatory bone or joint disease	Spinal manipulative therapy [Joint Mobilization or manipulation, up to 12 treatments completed by physical therapists]	General Exercise [Supervised by physical therapists on Stretching and strengthening, 12 treatments, 8 weeks] Motor Control Exercise [Supervised training of transversus abdominis and multifidus muscles by physical therapists)	Patient-Specific Functional Scale (PSFS), Visual Analogue Scale (VAS), Roland Morris Disability Questionnaire (RMDQ)	Spinal manipulative therapy and motor control exercise produce better short term outcome than general exercise, but there was similar effects between all three groups mid and long term.
(Goldby et al. 2006)	n= 346 Inclusion: >12 weeks LBP read and write English Ages 18-65 yrs Exclusion: non-mechanical LB, Spondylolisthesis >grade II, recent fracture, significant neurological signs, inflammatory joint disease, lower limb pathology, metastatic disease (past or present), medically unsuitable for exercise, Chronic Pain syndrome, >1 back surgery, anxiety neurosis, pregnancy	Manual Therapy [3 hour back school, exercise (not stabilization exercises), and manual procedures. Max 10 interventions.]	Minimal Intervention [3 hour back school, Educational Booklet.] Spinal Stabilization Program [# hour back school, Stabilization exercises for the spine and education (educational booklet). 10 x 1 hour classes]	LBP intensity, disability (Oswestry Disability Index), handicap, medication and quality of life.	Statistically significant improvements for spinal stabilization group (at 6 months for pain, at 1 year in medication, dysfunction and disability),

egorised as shown in Table 1 based on Levels of Evidence (Centre for Evidence Based Medicine, 2011).¹⁷ These studies met all the PICOS criteria. The other studies that did not meet all the PICOS criteria were excluded. There were no additional relevant studies identified by searching the reference list of the three chosen studies.

One study¹⁴ reported that spinal manipulation is more effective than individual physiotherapy or back school in reducing disability as measured by RMDQ at discharge time. More importantly, this improvement held consistently on all the follow-ups. Pain relief was also reduced at discharge time and maintained over the 3, 6, and 12 months follow ups. Furthermore, the spinal manipulation group also experienced a lower use of pain related medication during the period of follow-ups. Interestingly, in the follow ups it was found that after discharge, the spinal manipulation group sought care more frequently than the individual physiotherapy group or back school. This occurred despite their pain reduction at discharge, 3, 6, and 12 months follow ups.

The back school and individual physiotherapy provided similar results in the short term when compared to baseline however the individual physiotherapy subjects experienced more recurrences of frequent constant low back pain in the follow-ups and this difference became significant at 3 and 6 months from the baseline. Thus, back school appears to have provided better results than individual physiotherapy when it comes to promoting active treatment as the subjects experienced significantly less recurrences on all the follow-ups.

The second study¹⁵ reported the motor control exercise group and the spinal manipulative therapy group had slightly better outcomes than the general exercise group at 8 weeks but all three groups had similar outcomes at 6 and 12 months follow-ups. The results show that in the short term the motor control exercise and spinal manipulative therapy groups have better function and perception of effect than the general exercise group but this does not hold on the long term.

The third study⁹ reported that a spinal stabilization program is significantly more effective than manual therapy in all of the outcomes. It reduced pain intensity, disability, dysfunction, medication intake and improved the quality of life in patients with CLBP. Manual therapy was significantly more effective than a spinal stabilization program or minimal intervention in one outcome, pain. However

this was only significant with patients with the highest intensity.

Discussion

Three randomized controlled trials were reviewed in order to determine the effectiveness of spinal manipulation and therapeutic exercise on disability or pain related to CLBP in adults.

Cechi et al (2012) found that spinal manipulation showed the best improvement when compared with individual physiotherapy. Spinal manipulation appears to have produced the best results in both outcomes, pain reduction and improved function, however this has not been able to promote active self-treatment. This implies that spinal manipulation therapy depends on the availability of a specialist in spinal manipulation.

Ferreira et al (2007) found that spinal manipulation therapy and motor control exercise are better at reducing pain and disability than general exercise in the short term but not in the long term. All three interventions produce similar results in the long term. These results suggest that spinal manipulation therapy is an appropriate treatment modality for CLBP patients with high intensity pain. However, it should be utilized in conjunction with other modalities in order to have the best results in reducing disability, handicap and improving the quality of life.

Goldby et al (2006) found that spinal stabilization exercises were more effective than manual therapy in reducing pain intensity and disability and dysfunction. Interestingly, manual therapy was more effective in reducing pain in patients with the highest intensity.

These studies offer a glimpse of the literature available in general and suggest that there does not appear to be clear answers or conclusive evidence as to which treatment, spinal manipulation or exercise, is more effective in treating CLBP.

Perhaps the difficulties in finding conclusive evidence may lay in the entity of CLBP itself. It is by nature a heterogeneous entity that comprises a myriad of clinical signs and symptoms to offer different clinical scenarios in which a practitioner chooses an algorithm to diagnose CLBP. Then, the treatment choices are also a multitude of components that comprise exercise, manual therapy and spinal manipulation or any permutation of these.^{12,18}

Furthermore, spinal manipulation or spinal manipulation therapy is not necessarily clear and uniform across

the literature on what it exactly entails. In many cases it may include high-velocity thrust techniques or manual mobilization of the involved anatomical structures. In other cases, such as in one of the studies included in this review⁹ it did not provide sufficient detail on what manual therapy procedures are.

Another difficulty when dealing with spinal manipulation or spinal manipulation therapy, is that it is not an exact science and it cannot be measured directly, and as such it offers variability on its delivery and therefore the potential for error in measurement of effects. This is made more so by the fact that it is delivered by a variety of health care practitioners that have different training and different modes of delivery. This may make the study of the effects of spinal manipulation on CLBP more challenging especially when comparing studies in a systematic review.

This is in fact a major limitation of this review that the variables of spinal manipulation and exercise differ and vary significantly from each of the studies. This non-uniformity of variables makes it difficult to compare the studies or generalize on the results.

More comprehensive studies are required with more rigorous design, better defined sub-groups of CLBP patients, clearly defined interventions including cost-effectiveness in order for us to provide better evidence to guide practice.

Uncovering the evidence is crucially important for the chiropractic profession as spinal manipulation therapy and LBP have been the corner stone of our existence and will likely play as crucial a role in our future.

Conclusion

It is evident from the literature review that there is no conclusive evidence favouring either exercise (of various forms) or spinal manipulation as treatment of choice to provide effective improvements on patients with CLBP.^{9,12,14,15,18} For patients diagnosed with CLBP, joint mobilization and/or manipulation does not appear to provide better results than lumbar stabilization exercise programs. In this review, three studies offered different evidence as to which treatment is more effective.^{9,14,15} In one study⁹ prescribed therapeutic exercise provided significant improvements to CLBP patients when compared with spinal manipulation therapy where as in another study¹⁴ spinal manipulation offered the most improvements.

It is also evident from the literature review that the nature of CLBP is heterogeneous in terms of the cause, and as such, it is no surprise that the treatment choices are not definitive in their effectiveness in improving all CLBP.

Further research that compares both treatments is required to definitively identify the most effective choice of treatment for individuals suffering from CLBP.

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Appendix A
Search Strategy and Search Results

Database: Embase, 1974 to 2014 August 28, 2014

- 1 manipulation.mp. (77551)
- 2 exercise.mp. (329457)
- 3 chronic low back pain.mp. (5254)
- 4 1 and 2 and 3 (51)
- 5 limit 4 to (human and english language) (45)

Database: Ovid MEDLINE(R), 1996 to August 28, 2014

- 1 manipulation.mp. (44646)
- 2 exercise.mp. (151252)
- 3 chronic low back pain.mp. (2880)
- 4 1 and 2 and 3 (48)
- 5 limit 4 to (english language and humans) (45)

Database: CINAHL, 1982 to August 29, 2014

Search ID#	Search Terms	Search Options	Results
S5	S1 AND S2 AND S3	Limiters – English Language Search modes – Boolean/Phrase	43
S4	S1 AND S2 AND S3	Search modes – Boolean/Phrase	44
S3	“chronic low back pain”	Search modes – Boolean/Phrase	1,875
S2	“exercise”	Search modes – Boolean/Phrase	78,372
S1	“manipulation”	Search modes – Boolean/Phrase	8,814

Cochrane Central Register of Controlled Trials searched August 29, 2014

There are 47 results from 800283 records for the search on ‘manipulation in Title, Abstract, Keywords and exercise in Title, Abstract, Keywords and chronic low back pain in Title, Abstract, Keywords in Trials’

PUBMED, searched August 29 2014

There were 35 results for the search manipulation AND exercise AND chronic low back pain searched in all fields with the filters clinical trials, humans, English language applied.

Appendix B Final Articles Eliminated

1. 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... including commentary by Lindström I. *Spine*. 2003; 28(6): 525-532.
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