Spinal Manipulative Therapy for Acute Low Back Pain: A Clinical Perspective

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Low back pain (LBP) is the most prevalent musculoskeletal condition and a leading cause of disability[1]. In developed countries such as the United States and Australia, LBP prevalence ranges from 26–80%, with 12–33% of people reporting LBP on any given day[2,3]. In the US, back pain has been reported as the second most common reason for consulting a general practitioner[4]. LBP is extremely costly and places a great burden on the health system. A recent Australian health report listed back pain as the most expensive musculoskeletal health condition behind osteoarthritis[5]. Yet despite decades of research, we remain unsure about how best to classify the condition or how best to treat patients.

Acute LBP is widely defined as pain lasting less than 6 weeks[6,7]. While it is commonly believed that the majority of people with acute LBP recover with or without treatment within 4 to 6 weeks, recent evidence does not support this view[8,9]. A recent stufy of nearly 1000 primary care patients receiving care at the discretion of their clinician, found that only 39% were fully recovered by 6 weeks. The results of this study, and others like it[8], suggest that there is substantial scope for improving the outcome of acute LBP and that careful consideration of the types of treatment provided is necessary. While many treatments for acute LBP exist, one of the most widely used, but also most controversial, is spinal manipulative therapy (SMT). This term is applied to a group of treatments that includes both high-velocity manipulative techniques and low-velocity mobilization techniques.

This review aims to summarize the key research literature investigating the use of SMT in acute LBP in order to help clinicians make informed decisions about the use of SMT for their patients. The following issues are covered:

- LBP guideline recommendations regarding SMT
- Screening for precautions/contraindications to SMT
- The efficacy of SMT
- Optimal delivery of SMT (determining level, technique, force, frequency, etc)
- Which patients benefit most from SMT
- Directions for future research

ABSTRACT: Low back pain (LBP) is an extremely common cause of pain and disability. While many treatments for acute LBP exist, one of the most widely used, but also most controversial, is spinal manipulative therapy (SMT). This therapy includes both high-velocity manipulative techniques and low-velocity mobilization techniques. The literature regarding the use of SMT is often conflicting, which explains the difference in recommendations regarding SMT in international LBP guidelines. The lack of a clear tissue diagnosis in the majority of patients with LBP combined with the unknown mechanism of action of SMT adds to the difficulty for clinicians in providing SMT in a logical and effective manner. Despite these limitations, the existing literature does provide some assistance to clinicians on when to provide SMT and how to provide it in an optimal way. This review aims to summarize the key research literature investigating SMT in LBP in order to help clinicians make informed decisions about the use of SMT for their patients with acute LBP.

KEYWORDS: Clinical Decision Making, Clinical Prediction Rules, Screening, Spinal Manipulation

What Do LBP Guidelines Recommend?

Most, but not all, international guidelines recommend SMT as a treatment for non-specific acute LBP[10]. In the majority of guidelines where SMT is recommended, it is as a second-line intervention in patients who are slow to recover after the provision of simple analgesics and advice (first-line care)[10]. It is important to note

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that some guidelines are written primarily for medical practitioners and therefore provide recommendations about the appropriateness and timing of referring patients for SMT. For primary care clinicians such as physical therapists and chiropractors, it may be difficult to withhold SMT while they provide recommended first-line care, as their patients may expect to receive SMT early in treatment.

For physical therapists working in a primary care setting, a possible approach to practice would be to provide first-line care and monitor progress; if patients are improving rapidly, additional SMT may be unnecessary. A key issue is how long the therapist should wait. A recent review of international LBP guidelines found inconsistency between the recommendations regarding the optimal time to introduce SMT[11]. Interestingly, in a recent trial we conducted to determine whether addition of SMT hastened recovery from acute LBP, we found that 50% of patients managed with quality first-line care recovered within two weeks[12] regardless of additional interventions. Therefore, a sensible option might be to monitor progress with first-line care for two weeks and consider SMT for those who have not recovered by this time.

It is important to stress the key components of first-line care that are believed to be important to recovery. In our trial discussed above[12] where high rates of recovery were reported, all subjects received paracetamol (acetaminophen) in a time-contingent rather than pain-contingent manner. Patients took 1gm paracetamol 4 times per day until they recovered. The second important issue is that patients were reviewed by their clinician to monitor recovery and to reinforce the advice provided at the original consultation. All professionals who commonly provide SMT are capable of providing quality advice to patients and many are able to recommend simple over-the-counter analgesics.

Screening for Precautions/ Contraindications to SMT

Before SMT can be considered as a treatment option, patients with LBP need to be screened for possible serious pathology. There are two reasons for this: some conditions, such as a fracture, affect the mechanical integrity of the spine and would make SMT clearly dangerous. In other conditions, a failure to recognize the condition delays commencement of more appropriate care. For example, early detection and treatment of spinal malignancy is important to prevent the spread of metastatic disease and the development of further complications such as spinal cord compression.

Recent literature in this area has provided additional information to help clinicians interpret the commonly asked red-flag questions. The rate of serious pathologies in patients presenting to primary care appears to be lower than previously believed. In a cohort of 1172 patients with acute LBP presenting to general practitioners, physiotherapists, and chiropractors, only 11 were found to have a serious pathology as the source of acute LBP[13], yet most had at least one red flag positive. This result means that many positive red flags are likely to be false positives.

Two recent systematic reviews of red flags for identifying fracture and cancer in patients with LBP provide good information on the diagnostic accuracy of red flags for these two conditions. The cancer review found evidence for these red flags: age >50years, no improvement after 1 month, no relief with bed rest, and a previous history of cancer[14]. The fracture review found evidence for these red flags: age >50 years, female gender, major trauma, pain and tenderness, and a distracting painful injury[15]. For most red flags, the positive likelihood ratios were <4, and because the prevalence of serious pathology is ~1%, a single positive red flag does not appreciably change the likelihood of serious pathology. The exceptions were the red flag for cancer, "a previous history of cancer" (+LR=~20), and the red flag for fracture "major trauma" (+LR=~13). Applying these results to the application of SMT, the presence of the last two red flags should be considered as contraindications to SMT until further investigation has excluded serious pathology. The other red flags would only be contraindications to SMT if more than one were positive.

The Efficacy of SMT

Two recent systematic reviews found small benefits of SMT compared to no treatment or ineffective treatments but no evidence of superiority compared to other common treatments for LBP[16,17]. The Assendelft[16] meta-analysis revealed that patients with acute LBP who received SMT had lower pain and disability levels (pain: 10mm, 95% CI: 2 to 17mm, on a 100mm visual analogue scale; disability: 2.8, 95% CI:–0.1 to 5.6, on the 24-point RM scale.) compared to patients receiving placebo or ineffective control. The effect size is small and may explain why some guidelines do not recommend SMT for acute LBP. However, the Ferreira[17] review reported larger, and what many regard as clinically important, effects: 18mm (95% CI: 13 to 24) compared to placebo and 17mm (95% CI: 8 to 26) compared to no treatment for pain outcomes. The effect for disability reduction was 5 points on the 24-point RM scale (95% CI: 2 to 9).

Recently two high-quality trials have published seemingly conflicting results regarding the efficacy of SMT in patients with acute LBP[12,18]. Hancock et al[12] found that the addition of SMT did not speed recovery from pain in patients presenting to primary care practices who received first-line care of advice and regular paracetamol. Childs et al[18], however, found that SMT was effective for a subgroup of patients with LBP who met a clinical prediction rule (CPR). There are several plausible explanations for the different results, which can help deepen our understanding of SMT for patients with LBP. One clear difference between the trials is the provision of first-line care of regular analgesics and advice in the Hancock et al[12] trial compared with active exercises, which were provided in the Childs et al[18] trial. It is possible that when quality baseline care is provided, previously effective treatments such as SMT might no longer provide additional benefit. Another possible explanation for the results is that SMT is only effective for a subgroup of patients.

What Is the Best Way to Deliver SMT?

There are many different approaches to the delivery of SMT. These approaches usually relate to hypothesized mechanisms as to how SMT exerts its effects. This dictates the range of SMT techniques used and how to progress treatment. Most of the treatment models used depend upon the clinical experience and professional background of the advocate(s) and inferences from basic sciences. In most cases, the treatment model predates the basic science research that is used to support the model. There are no treatment models that have been prospectively derived from an evaluation of available research from the basic and clinical sciences.

Central to many treatment approaches is the notion that better clinical outcomes result from specific SMT that is matched to the patient's clinical presentation. The aspects of SMT that can be varied include the spinal level treated, technique used, direction and magnitude of the applied force, use of static or oscillatory forces, and desired symptom response during treatment.

One way to obtain information on whether matched SMT treatment provides better results than unmatched treatment is to compare the results of trials that do and do not allow clinician choice in the delivery of SMT. The only systematic review on this topic concluded that there were no systematic differences in favor of clinical trials that allowed the clinician choice of treatment technique[19]. However, it needs to be remembered that this is a non-randomized comparison and that the trials might have differed in other ways (apart from clinician choice) that could influence treatment effects. Accordingly, the best evidence on this issue will come from trials that have directly tested aspects of treatment choice as a randomized comparison.

Published literature provides some insight into the importance of both the specific SMT technique used and the spinal level at which it is applied. A randomized trial by Chiradejnant et al[20] found that the level at which SMT techniques are applied does influence treatment effectiveness. When treatments were applied to the level the therapist felt most appropriate, rather than a randomly selected level, patients received significantly greater improvements from SMT. In a subsequent trial, the same authors investigated if the specific SMT technique selected influenced treatment effectiveness. The authors found no difference between the therapist-selected technique and a randomly selected low-velocity mobilization technique[21]. The level the treatment is directed to therefore seems important; however, the type of technique chosen does not. While ambiguity about the optimal technique exists, it is important for therapists to closely reassess a patient's response to any single SMT technique and either continue or change the selected technique based on the individual patient's response to treatment. As response to SMT can be very rapid, reassessment during and immediately after provision of a technique is highly recommended[22].

Provision of SMT at the most appropriate level requires an adequately reliable method of identifying the appropriate level. Much has been written about the reliability of manual assessment of the spine[23]. While identification of lumbar posteroanterior stiffness has poor to fair reliability (ICC 2,1: <0.4), the reliability of identifying the most painful lumbar level is better (ICC 2,1: 0.7)[23]. Attempts have been made to improve the reliability of manual stiffness judgements by providing specific feedback to students during training of stiffness judgement skills[24,25], and by getting students to reference their judgement to a spring of known stiffness[25]. While referencing judgements to a spring improves reliability, training seems ineffective.

Interestingly, the poor reliability of manual stiffness judgements may have little influence on treatment. Chiradejnant et al[20] found that the treatment effect is better when the therapist-selected level (most symptomatic or dysfunctional level) is treated rather than a randomly selected level. It is unclear how therapists select the most appropriate level but it is likely that a patient's pain response to the application of posterior-anterior (PA) force would be weighted heavily. There has been no investigation into the importance of treating the most hypomobile level; however, the existence of at least one hypomobile level is one of the five items that must be positive for inclusion on the SMT CPR developed by Flynn et al[26]. Fascinatingly, there is little evidence to support the existence of a relationship between LBP and lumbar posteroanterior stiffness, or that SMT changes lumbar posteroanterior stiffness[27]. Only one early study has demonstrated that posteroanterior lumbar stiffness, measured using a mechanical device, is increased in patients with LBP compared to when they have little or no pain[28]. A recent MRI study found no relationship between lumbar segmental motion and pain response to a PA mobilization[29].

SMT is sometimes divided into high-velocity manipulative techniques and low-velocity mobilization techniques. While some believe the efficacy of one type is superior to the other, a systematic review of all available trials did not find evidence to support this view[16]. While it may seem that evidence on this issue could be obtained from a comparison of the results of mobilization trials to those of manipulation trials, this approach has major problems. It is likely that trials differ in other ways, e.g., methodological quality, co-interventions, outcomes, patients etc, that are equally likely to explain any differences between trials. The only adequate design to compare the relative efficacy of these two approaches to SMT is a head-to-head comparison within the same trial. Currently, there is no quality evidence suggesting superiority of either approach[16,30]. Future quality trials in this area would be informative, and the protocol for a trial that should help address this question specifically in patients who meet the CPR of Childs et al[18] has been published[31].

Is it Possible to Identify Patients who Benefit Most from SMT?

Like many physical therapy interventions for LBP, the search for a potential subgroup of responders to SMT has been widely reported as a key to improving the effectiveness of SMT. The premise is that LBP is a heterogeneous disor-

der, and it is not reasonable for one treatment to be effective for all patients. The randomized trial by Childs et al[18] found that a CPR was able to identify a group of patients who responded better to SMT (compared to control) than patients who were not positive to the rule. The CPR required patients to meet at least 4 of 5 criteria. The criteria were duration of current symptoms < 16 days, no pain extending past the knee, Fear Avoidance Beliefs Questionnaire[32] work subscale <19, ≥1 hypomobile segment in the lumbar spine, and ≥1 hip with >35 degrees of IR. The promising results of this trial were published in a high-profile journal and have been very highly cited.

A recently published secondary analysis of the Hancock et al[33] trial provides some reason for caution regarding the generalizability of the CPR for identifying subgroups of responders to SMT. Hancock et al[33] investigated whether the CPR used by Childs et al[18] could be generalized and identify responders to SMT, but they found that this was not the case. In the Hancock et al[33] study, patients who were positive on the rule did not respond better to SMT (compared to control) than patients who were negative on the rule[33]. There are several differences between the Childs et al[18] study and that of Hancock et al[33] that could explain these different findings. Hancock et al[33] allowed clinicians to use a variety of SMT techniques with most therapists choosing to use low-velocity mobilization techniques, while in the Childs et al[18] study, all clinicians used the same high-velocity technique. It is possible that the difference in the way the treatment was applied explains the different findings and that the CPR may not generalize to low-velocity techniques. There is a need to investigate if the CPR generalizes to high-velocity techniques other than the one used in the original Childs et al[18] study. It is also possible that the lack of generalization of the CPR is not due to the differences in the type of SMT used but other differences between the trials such as the co-interventions, setting, or patients. Further research is required to determine in what patients and settings, and for what techniques the CPR for SMT does generalize. While the CPR currently provides the best evidence for identifying patients likely to respond to SMT, clinicians using the rule need to consider that the rule may not generalize to their particular patient or setting. Until further research is available to clarify how generalizable the CPR is, we would recommend that therapists regularly re-assess their individual patient's response to SMT to ensure that the response is positive and if not, to change management approach regardless of status on the CPR.

The treatment algorithm investigated by Brennan et al[34] provides some guidance to clinicians on which patients are likely to respond best for a range of different treatment approaches including SMT. This approach helps clinicians identify patients likely to respond to one of three broad approaches: manipulation, specific exercise (directional preference exercises[35]), or stabilization exercises. In a well-designed randomized controlled trial, those authors found that patients who received treatment matched to their classification did better than patients who did not receive matched treatment[34]. Identification of patients likely to respond to SMT was based on a modification of the criteria used by Childs et al[18]. The algorithm used by Brennan et al[34] forced all patients into one treatment group and it is unclear what proportion of patients belonged to more than one of these treatment groups or did not truly fit any of the groups. It is likely some patients who were classified using the algorithm into a group other than the manipulation group, such as the specific exercise group, might also meet the criteria for the manipulation group as developed by Childs et al[18]. Whether these patients would benefit more or less from SMT compared to the treatment identified using the algorithm is unclear. It is also possible that they might benefit most from a combination of both treatment approaches. It seems reasonable to start a patient with the treatment approach according to his or her classification on the algorithm and then for those patients who also meet the criteria for the manipulation group, to add a single treatment of manipulation and closely monitor the effect of this additional intervention.

In any health condition, the need for different degrees of intervention should be informed by knowledge of the likely prognosis of the condition without intervention. There is no doubt from the literature on prognosis of LBP that a proportion of patients with acute LBP recover quickly with either no intervention or simple treatments such as regular analgesics and advice. The ability to accurately identify those patients who will recover quickly without the need for more complex and expensive treatments such as SMT is clearly important. It is difficult for SMT to provide worthwhile benefits in patients who will recover rapidly anyway, and inclusion of these patients in clinical trials is one possible reason for the small effects reported. A significant amount of research has identified those patients at high risk of becoming chronic and not recovering[36-38], but little investigation has been performed into identifying those patients likely to recover quickly regardless of treatment. We recently published a study that found that patients meeting three criteria had a highly favorable prognosis regardless of treatment[39]. Patients with lower than average initial pain intensity (≤ 7, using NPR 0–10 scale), shorter duration of symptoms (≤ 5 days), and fewer previous episodes (≤ 1) recovered more quickly (HR = 3.5, 95% CI, 1.8–7.0) than patients without these characteristics. Patients who had all three of these characteristics had a 60% chance of being recovered by just one week and 95% chance by four weeks. The results of this study need to be shown to generalize to new settings and patients. This group only accounted for 10% of our cohort, however, and for these patients at least, it seems reasonable to consider holding back on expensive treatments like SMT as the likelihood of recovery is very high with simple analgesics and advice.

Future Research

While the existing research literature provides some assistance to clinicians regarding the application of SMT, there are many unanswered questions. Research aimed at answering the most im-

portant questions is urgently needed. The CPR of Childs et al[18] clearly justifies further investigation. It is vital to determine in what settings and for what techniques the rule generalizes. Establishing the relative efficacy of different techniques, especially low-velocity and high-velocity techniques, is clearly important. With cheap simple treatments such as advice and simple analgesics widely recommended, it is important to investigate the efficacy of SMT in addition to these interventions. While not all authors agree, we believe a greater understanding of the source of LBP and the mechanisms by which SMT works is essential to determining the optimal delivery of SMT, including which patients respond best and which techniques are most effective for different patients.

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