Spinal manipulative therapy and acupuncture for chronic low back pain: a systematic review and meta-analysis of RCTs

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Research Article

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Abstract

Background

Spinal manipulation therapy (SMT) and acupuncture are commonly used for low back pain (LBP) among complementary and alternative therapies. However, it remains unclear which of the two therapies is more effective for LBP. Therefore, the purpose of this meta-analysis was to evaluate the effectiveness of SMT and acupuncture on LBP.

Methods

Four electronic databases were searched for randomized controlled trials (all years until July 2021), including PubMed, Embase, Web of Science, and Cochrane Library. Two reviewers independently abstracted data, assessed risk of bias, and rated the quality of evidence. The primary outcome was pain; secondary outcomes included functional status and adverse events. Review Manager 5.3 software and Stata 12.0 were used for all statistical analyses.

Results

9 RCTs with a total of 714 participants were identified, who were on average middle aged (39-60 years) without signs of radiating pain. These trials included patients with mild to moderate pain. Overall, moderate quality of evidence suggested that SMT had better effects for pain relief (MD: 0.32, 95%CI: 0.09 to 0.55, $I^2=34\%$) and similar effects in function (MD: 0.24, 95%CI: -0.45 to 0.94, $I^2=21\%$) when compared to acupuncture. Moderate quality of evidence showed SMT reduced pain better than acupuncture at month 2 (MD: 0.61, 95%CI: 0.08 to 1.14, $I^2=0\%$) and at month 12 (MD: 1.02, 95%CI: 0.28 to 1.75, $I^2=42\%$). In addition, Low quality of evidence showed SMT may provide better improvement in pain at month 3 (MD: 0.74, 95%CI: 0.09 to 1.39, $I^2=42\%$) and in function at month 4 (MD: 3.50, 95%CI: 0.71 to 6.29). Adverse events associated with SMT and acupuncture were rare and mild.

Conclusions

SMT showed better effects than acupuncture for chronic low back pain, while SMT and acupuncture had similar effects in functional improvement. Although SMT and acupuncture were tolerable and safe, patients should be informed about the potential risks of adverse events before starting therapy.

Introduction

Low back pain (LBP) is the leading cause of disability in both developed and developing countries, imposing enormous health and economic burdens on society[1, 2]. Not only physiological pain but also

some psychological pressure, such as depression and anxiety, were caused by LBP[3, 4]. The current clinical options include non-steroidal anti-inflammatory drugs (NSAIDs), opioid drug, oral glucocorticoids and surgery[5–7]. However, drug therapy has obvious side effects and adverse reactions[6, 8]. Surgery is not necessary because of favorable natural history of LBP[9, 10]. Therefore, non-pharmacological therapies for LBP are becoming the preferred choices[11–13].

Non-pharmacological therapies for LBP include spinal manipulation therapy (SMT), acupuncture, exercise therapy, massage, yoga, cognitive behavioral therapy, and intensive interdisciplinary treatment[3, 9, 10]. Among complementary and alternative (CAM) therapies, spinal manipulation therapy (SMT) and acupuncture are commonly used for LBP[14–16]. In some countries, SMT and acupuncture are recommended in international clinical guidelines and as first-line treatments[10, 17]. Some studies comparing the effect of SMT and acupuncture on pain relief and functional improvement showed that SMT was more effective while others had opposite results[18–20]. As we know, choosing an effective and safe treatment could avoid wasting time and effort. However, although SMT and acupuncture are widely used, which type of treatment is most effective remains unclear.

In order to resolve this issue, we conducted a systematic review and meta-analysis. The primary outcome was to assess the effectiveness of SMT on pain relief when compared to acupuncture for adults with LBP. Secondary outcomes were to assess functional improvement and adverse events.

Methods

This review was performed in strict accordance with the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines[21]. Additionally, the protocol for this study was registered with PROSPERO (registration number: CRD42021256789).

Searching strategies

We searched the following electronic databases for randomized controlled trials: PubMed, Embase, Web of Science, and Cochrane Library (all years until July 2021). An experienced information specialist was consulted to help develop the search strategy according to recommendations in the Cochrane Handbook of Systematic Reviews[22]. The search strategies databases are shown in Additional file 1.

Criteria for including studies for this review

Only RCT studies were included. Studies without randomization had to be excluded. Gray literature was excluded. Studies were considered eligible for inclusion if they were of a prospective design, included adults (age ≥ 18 years) and more than 50% of the subjects had pain for more than 3 months. In addition, the treatment group was SMT and the other group was acupuncture. In this review, we excluded studies of pelvic pain due to pregnancy, pain unrelated to the lower back, postpartum low back pain, sciatica, postoperative studies, participants with severe pathology, and studies related to maintenance or preventive therapy.

Outcome measures

The primary outcome was pain intensity, as measured using a Visual Analogue Scale (VAS; 0–10) or Numerical Rating Pain Scale (NRS; 0–10). The secondary outcomes included functional disability and adverse events. Functional disability was assessed using Disability Index questionnaires (higher scores indicating greater disability). Adverse events were summarized descriptively.

Data extraction and Risk of bias assessment

The data were extracted from each study with a standardized form and the data integrity was cross-evaluated by two researchers. In case of disagreement, a decision was made through discussion or by a third researcher (**Fan**) if necessary. Data extraction included the following information: design type (RCT), the authors of studies, year of publication, demographic characteristics of the intervention and control group, outcome data, follow-up intervals, adverse events, and other data, such as declaration of interests, risk of bias. The authors were contacted when necessary. The risk of bias in the included RCTs was assessed using the Cochrane Risk of Bias Tool, including selection bias, performance bias, detection bias, attrition bias, and reporting bias. These criteria were classified risk of bias as high, moderate, low and unclear[22].

Data analysis

Review Manager 5.3 software (Cochrane Collaboration) and Stata 12.0 (Stata Corp) were used for all statistical analyses. The mean difference (MD) and 95% confidence intervals (CI) was used for pain and functional status. Dichotomous data were analyzed by calculating the pooled risk ratio (RR). Statistical heterogeneity was examined by a chi-square test (Cochran's Q test) and I^2 test[23], and $P < 0.1$ was used to indicate the presence of heterogeneity. In each case, if $P < 0.1$ and $I^2 \geq 50\%$, the more conservative random-effects models was used[24]. If $P > 0.1$ and $I^2 < 50\%$, a fixed-effects model was used.[25]. The source of heterogeneity between studies was assessed using subgroup analysis. Sensitivity analysis was subsequently performed to assess the stability of results. Funnel plot was used to assess publication bias.

Results

Literature search

Four thousand four hundred and nine records were identified from four databases. After the literature search, 3,368 duplicates were excluded. 803 records were excluded due to the title or abstract were not eligible. In the remaining 238 records, 229 studies were excluded for the

following reasons: animal researches, no data available, no back pain, no comparison, inappropriate comparison, reviews. As a result, a total of 9 RCTs were included with 714 patients in this meta-

analysis[18–20, 26–31]. The detailed process of studies identification and screening was provided in Fig. 1.

Characteristics of the included studies

The general information of the included studies is shown in Table 1. In the included studies, the majority of patients were middle-aged patients without signs of radiating pain, typically averaging 39 to 60 years of age. Although less than half of studies described evaluation of symptom severity, most of patients reported mild to moderate pain among these studies. All of the eligible patients in the included studies had more than 6 weeks of low back pain and were performed by experienced operators using optimal technique. Moreover, none of the studies clearly distinguish between persistent low back pain and exacerbation of a chronic condition.

Risk of bias in individual trial

More than half of the studies (55.6% (n=5/9)) used both a random sequence generation and an allocation concealment[20, 26-28, 31]. None of the studies attempted to blind patients. Less than half of the studies (44.4% (n=4/9)) attempted to blind outcome assessors[18, 26, 28, 29]. More than half of the studies (66.7% (n=6/9)) provided an adequate follow-up and kept loss to follow-up to a minimum[18, 26-28, 30, 31]. The risk of bias assessments of included studies is summarized in Fig. 2, 3.

Analysis of overall effects

Table 2 summarizes the therapeutic effects of all included studies.

Primary outcomes (Pain relief):

Eight studies compared the pain relief of SMT with acupuncture at different time points[18-20, 26-29, 31]. Overall, moderate quality of evidence suggested that SMT may reduce pain compared with acupuncture. More than half studies (n=6/9) with high to moderate quality of evidence achieved a “moderate” assessment. Likewise, moderate quality of evidence showed SMT may reduce pain better than acupuncture at month 2 and 12, and the same result was showed at month 3 based on low quality of evidence (Fig 4.). Sensitivity analyses and random-effects models were conducted, while the results remained similar.

Secondary outcomes (functional status):

Eight studies compared the functional status of SMT with acupuncture at different time points[18-20, 26-30]. Overall, Moderate quality evidence suggested that there was no statistical difference between SMT and acupuncture, while low quality of evidence showed that SMT may provide better effects compared with acupuncture at month 4(Fig 5.). Sensitivity analyses and random-effects models were conducted, while the results remained unchanged. Funnel plots showed no evidence of publication bias (Fig 6.)

Adverse events:

Less half of the studies (33.3% (n=3/9)) examined adverse events (table 3). However, one of these studies examined the incidence of these events[27]. That study (n=172) suggested 13% of patients in the SMT group and 11% in the acupuncture group reported significant pain or discomfort during or shortly after treatment. There was no serious adverse event described in the included studies.

Discussion

Spinal manipulation therapy (SMT) and acupuncture are commonly used for the treatment of LBP and recommended as first-line treatments in most countries[10, 17]. However, it's not clear which of the two therapies is more effective. This meta-analysis included 9 RCTs with 714 patients to evaluate the efficacy and safety of SMT and acupuncture for LBP. Based on moderate quality evidence, overall analysis suggested that SMT may reduce pain compared with acupuncture, while there was no statistical difference between SMT and acupuncture for improving function. Moderate quality of evidence showed SMT may reduce pain better than acupuncture at month 2 and 12, and the same result was showed at month 3 based on low quality of evidence. Low quality of evidence showed SMT may provide better functional improvements compared with acupuncture at month 4. Sensitivity analyses and random-effects models did not significantly change the results. Finally, there was no serious adverse event described in the included studies.

SMT and acupuncture was prevalently used among patients with chronic LBP[32–34]. Among CAM treatments for low back pain, receptivity was highest for acupuncture and SMT therapies by physician and patients[34, 35]. Most studies validated effects of SMT and acupuncture in clinical trials and therefore this might increase the reliability of the outcomes[14, 15, 36]. Evidence quality of included studies was limited by low-to-moderate quality, suggesting some uncertainty surrounding research results. However, these results were similar in sensitivity analyses and random-effects models. In addition, we further performed subgroup analyses by number of patients and publication time. There was small significant difference in the subgroup of patients with less than this number ($n \leq 35$), indicating SMT may reduce pain better than acupuncture, while the remaining results were not statistically significant differences. The result may be inaccurate and have possible bias due to the small sample sizes. Furthermore, our results are largely consistent with other published high-quality reviews [37, 38].

Limitations of this study

Although we conducted a comprehensive review of the literature on using SMT and acupuncture to treat patients with LBP, there are some limitations. The main limitations are similar to most systematic reviews—namely, the variable quality and data integrity of included studies, as well as ambiguity about the impact of publication bias. Furthermore, we were unable to resolve the problem related to statistical heterogeneity, and this reduced the reliability of the evidences in our meta-analysis. Finally, most studies were conducted in the United States and Australia, and a few studies in China and other countries due to various reasons were excluded, which may cause potentiality for bias.

Conclusions

Overall, SMT produces a better effect for chronic low back pain in pain reduction compared with acupuncture, especially at the medium and long-term follow up. For back specific functional status, SMT may provide better medium-term effects compared with acupuncture. Adverse events associated with SMT and acupuncture were rare and mild, and there were no severe adverse events.

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Tables

Table 1. Summary of clinical and treatment characteristics for all included studies

Author	Study type	Radiating pain	Duration of LBP	Duration of treatment	Treatments	Quality of the study
Anupama 2017	RCT	no	Imprecision	2 months	SMT vs AC	low
Cherkin 2001	RCT	no	>6 weeks	2 months	SMT vs AC	moderate
Griswolda 2019	RCT	no	>6 weeks	1 month	SMT vs AC	high
Kalauokalani 2001	RCT	no	>6 weeks	2 months	SMT vs AC	moderate
Kizhakkeveettil 2019	RCT	no	>6 weeks	2 months	SMT vs AC	low
Klassen 2019	RCT	no	Imprecision	2 weeks	SMT vs AC	moderate
Lynton 1999	RCT	no	>13 weeks	1 month	SMT vs AC	moderate
Lynton 2003	RCT	no	>13 weeks	2 months	SMT vs AC	moderate
Muller 2005	RCT	no	>13 weeks	2 months	SMT vs AC	moderate

Footnotes: SMT = spinal manipulative therapy; AC = acupuncture;

Table 2. Summary of therapeutic effects and GRADE assessment for all included studies

					Quality of evidence
Analyses	Effect estimate (95% CI)	studies	participants	I ² (%)	(reason for downgrading)
SMT versus Acupuncture					
Pain:					
2 week	-1.61 (-3.86 to 0.65)	3	199	49	Moderate (inconsistency)
1 month	-0.16 (-0.56 to 0.24)	5	482	31	Moderate (inconsistency)
2 month	0.61 (0.08 to 1.14)	4	339	0	Moderate (limitations)
3 month	0.74 (0.09 to 1.39)	2	241	42	Low (limitations, imprecision)
4 month	0.90 (-0.18 to 1.98)	1	69	-	Low (limitations, imprecision)
12 month	1.02 (0.28 to 1.75)	3	248	42	Moderate (inconsistency)
Total	0.32 (0.09 to 0.55)	18	1578	34	Moderate (limitations)
Function:					
2 week	-2.75 (-6.61 to 1.12)	3	199	49	Moderate (inconsistency)
1 month	0.41 (-2.18 to 2.99)	4	354	55	Moderate (inconsistency)
2 month	0.14 (-0.90 to 1.17)	5	476	0	Moderate (limitations)
3 month	0.36 (-0.81 to 1.52)	3	378	0	Low (limitations, imprecision)
4 month	3.50 (0.71, 6.29)	1	69	-	Low (limitations, imprecision)
12 month	0.12 (-1.53, 1.76)	3	248	0	Moderate (inconsistency)
Total	0.24 (-0.45, 0.94)	19	1724	21	Moderate (limitations)

Table 3. Summary of adverse event reporting for all included studies

Study, sample size	Methods used to assess adverse events	Adverse events reporting	Adverse events reported (for SMT or control group)
Lynton 1999, n=48	Not reported	Any adverse event	No adverse events reported
Cherkin 2001, n=172	Self-reported during treatment and follow-up	Any adverse event	No serious adverse effects were reported by any patients.
Lynton 2003, n=47	Self-reported during treatment and follow-up	Any adverse event	No adverse events reported
Muller 2005, n=43	Not reported	Any adverse event	No adverse events reported
Anupama 2017, n=69	Self-reported during treatment and follow-up	Any adverse event	No adverse events reported
Kizhakkeveetil 2019, n=51	Not reported	Any adverse event	No adverse events reported
Griswolda 2019, n=65	Not reported	Any adverse event	No adverse events reported
Kalauokalani 2001, n=137	Not reported	Any adverse event	No adverse events reported
Klassen 2019, n=126	Not reported	Any adverse event	No adverse events reported

Figures

Figure 1

Selection of studies through review

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Anupama 2017							
Cherkin 2001							
Griswolda 2019							
Kalauokalani 2001							
Kizhakkeveetil 2019							
Klassen 2019							
Lynton 1999							
Lynton 2003							
Muller 2005							

Figure 2

Risk of bias assessment using the Cochrane tool

Figure 3

Risk of bias assessment using the Cochrane tool

Figure 4

Forest plot: SMT vs acupuncture for pain

Figure 5

Forest plot: SMT vs acupuncture for functional status

Figure 6

Funnel plots of pain and functional status.

Publication bias: $P = 0.162 > 0.05$

Supplementary Files

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