Systematic Review and Meta-Analysis

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The efficacy of kinesio taping as an adjunct to physical therapy for chronic low back pain for at least two weeks

A systematic review and meta-analysis of randomized controlled trials

Guangchen Sun, MB, Qiliang Lou, MB*

Astract

Background: Kinesio taping (KT) is a relatively new treatment method for chronic low back pain (CLBP). The effectiveness of KT as an adjunct to physical therapy (PT) for CLBP remains controversial.

Objective: The aim of this updated meta-analysis was to critically examine and evaluate the evidence of recent randomized controlled trials regarding the effectiveness of KT as an adjunct to PT for CLBP for at least 2 weeks.

Methods: This systematic review and meta-analysis was written following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines. Seven electronic databases including Web of Science, Embase, PubMed, Wanfang Data, Scopus, Science Direct, Cochrane Library were searched in September 2020 by two independent reviewers. The risk of bias was assessed using the Cochrane Collaboration's tool. Data analysis was performed with Review Manager Software.

Results: Twelve randomized controlled trials with a total of 676 patients were included in our study. Mean improvements were significantly higher in the KT+PT group than the PT group for pain score (SMD, 0.73 [95% CI, 0.37–1.08], $P < .00001$) and disability (SMD, 1.01 [95% CI, 0.42–1.59], $P = .0007$). Of 12 studies based on the pain score, 7 reported KT+PT patients to have significantly less pain at latest follow-up when compared with PA patients ($P < .05$). Of 11 studies based on the disability, 8 reported KT+PT patients to have significantly better improvements at latest follow-up when compared with PA patients ($P < .05$).

Conclusion: Kinesio taping combined with physical therapy provided better therapeutic effects regarding pain reduction and disability improvement compared with physical therapy alone in individuals with chronic low back pain.

Limitation:

1. Included studies and sample sizes were small and most studies were with moderate evidence level;
2. several important outcomes such as range of motion and distance walked were lack;
3. heterogeneity among the included studies was unavoidable.

Abbreviations: CI = confidence interval, CLBP = chronic low back pain, KT = kinesio taping, PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses, PT = physical therapy, RCTs = randomized controlled trials, SMD = standardized mean differences.

Keywords: chronic low back pain, kinesio taping, meta, pain control, physical therapy, review

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The authors have no conflicts of interest to disclose.

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

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1. Introduction

Low back pain is defined as pain between the 12th rib and the inferior gluteal folds. Chronic low back pain (CLBP) is defined as back pain lasting more than 12 weeks. The causal factors of CLBP are identified in 5% to 15% of cases, whereas more than 85% of patients exhibit nonspecific low back pain. Most patients suffer from CLBP for over a year, and only 25% recover fully, without disability.[1–3]

Several treatment strategies for CLBP are provided in the current literature, which including limited bed rest, pharmacological therapy, acupuncture, and general exercises. A relatively new treatment method for CLBP is Kinesio taping (KT), which is being widely used as a relatively novel band-aid method to reduce the pain of musculoskeletal disorders.[4] KT is an elastic bonding material containing high tensile capacity, which ensures the free movement of the application area without the need of drugs or chemicals.[5–7] Studies have shown that KT improves blood and lymph circulation, mitigates pain, adjusts joints, and relives muscle tension.[8]

One meta-analysis demonstrated that KT could improve pain and function in patients with CLBP compared with sham taping.[9] Another recent meta-analysis investigated the effects of KT in patients with CLBP and found no evidence to support the use of KT in clinical practice for patients with CLBP.[10] The other reviews could not reach conclusive evidence of bright side of KT.[11] To the best of our knowledge, only a meta-analysis has compared the therapeutic efficacy of KT combined with physical therapy (PT) and PT alone for pain control in patients with CLBP.[10] However, only 5 studies were included in the meta-analysis,[12–16] and a good number of new trials have been published since then. Therefore, the aim of this updated meta-analysis was to critically examine and evaluate the evidence of recent randomized controlled trials regarding the effectiveness of KT as an adjunct to PT for CLBP for at least 2 weeks. The results of this study will provide new information about the usefulness of KT as an additional component of a guideline-endorsed physiotherapy program in patients with CLBP.

2. Materials and methods

2.1. Selection of studies

This systematic review and meta-analysis was written following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines. Seven electronic databases including Web of Science, Embase, PubMed, Wanfang Data, Scopus, Science Direct, Cochrane Library were searched in September 2020 by two independent reviewers (lasting for 1 week). For search on PubMed, the search terms used were "Kinesio taping OR Kinesio tape OR Kinesiotape AND chronic low back pain OR chronic non-specific low back pain OR non-specific low back pain." The reference lists of the included studies were also checked for additional studies that were not identified with the database search. There was no restriction in the dates of publication or language in the search. No ethical approval was required in our study because all analyses were based on aggregate data from previously published studies.

2.2. Inclusion and exclusion criteria

Study included in this systematic review and meta-analysis had to meet all of the following inclusion criteria in the PICOS order:

1. participants: patients with CLBP should present with an episode of chronic pain with limitation of motion in the lower back and demonstrate a normal low back on X-ray, magnetic resonance imaging or computed tomography;
2. Intervention: patients received KT+PT;
3. comparator: patients received PT alone;
4. outcomes: outcomes which assessed pain intensity or disability;
5. study design: randomized controlled trials.

The exclusion criteria were as follows:

1. outcomes which assessed pain intensity or disability were not reported;
2. no direct comparison of KT+PT and PT;
3. studies with the following types: case reports, comments or letters, biochemical trials, protocols, conference abstracts, reviews, and retrospective studies or prospective non-randomized studies.

2.3. Study selection

Articles were exported to EndNote, and duplicates removed. Two independent authors screened the titles and abstracts of potentially relevant studies to determine their eligibility based on the criteria. Disagreements were resolved through a discussion with a third review author.

2.4. Data extraction

Data were extracted by review of each study for population, mean age, gender, follow-up duration, study design, publishing date, KT and PT characteristics, and outcomes assessment. The two reviewers created a study-specific speadsheet in Excel (Microsoft Corp., USA) for data collection. Data extraction was performed independently, and any conflict was resolved before final analysis. Any disagreements between the two reviewers were discussed and, if necessary, the third author was referred to for arbitration. If the data were missing or could not be extracted directly, authors were contacted by email. Otherwise, we calculated them with the guideline of Cochrane Handbook for Systematic Reviews of Interventions 5.1.0. If necessary, we would abandon the extraction of incomplete data.

2.5. Quality assessment

The GRADE system (Grading of Recommendations Assessment, Development and Evaluation) was used by two independent reviewers to rate the overall quality of evidence in each pooled analysis. The following 7 items were used to assess the quality of randomized controlled trials: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other bias. The quality rating high is reserved for evidence based on randomized controlled trials. The quality rating moderate, low, or very low were rated depending on the following four factors: risk of bias, inconsistency of effect, imprecision, and indirectness. When the heterogeneity was high, inconsistency was considered serious. When there was no direct comparison between KT + PA and PA alone, indirectness was considered serious and researchers had to make comparisons across studies. When there was fewer than 400 participants for each outcome, imprecision was considered an appreciable risk.

Any controversy was resolved by discussing with a third author to reach a final consensus. Kappa values were used to measure the degree of agreement between the 2 reviewers and were rated as follows: fair, 0.40 to 0.59; good, 0.60 to 0.74; and excellent, 0.75 or more.

2.6. Statistical analysis

Data analysis was performed with Review Manager Software (RevMan Version 5.4, The Cochrane Collaboration, Copenhagen, Denmark). As outcomes which assessed pain intensity and disability were reported on different scores, we used the standardized mean difference (SMD) with a 95% confidence interval (CI) to assess for these outcomes. A P value $< .05$ was considered statistically significant. All outcomes were pooled on random-effect model. The statistical heterogeneity was assessed by using the Cochrane Q test and I^2 statistic. The low, moderate, and high heterogeneity were assigned to I^2 values of 0% to 25%, 26% to 74%, and above 75%. A meta-analysis was conducted when 4 or more trials reported an outcome of interest. A subanalysis was performed to isolate results from patients who received KT+PT and PT alone. A sensitivity analysis was planned by different follow-up periods. Begg's funnel plot was used to assess publication bias. If publication bias exists, the Begg's funnel plot is asymmetric.

3. Results

3.1. Study selection, characteristics

The initial search used very broad terms and resulted in 573 total articles. Twelve studies met inclusion and exclusion criteria and were included in our study. Briefly, 12 RCTs with a total of 676 patients were included (Fig. 1).[12–23] Among the 12 RCTs, a total of 676 patients participated (339 randomized to the intervention group, 337 randomized to a control group) with a follow-up rate of 100%. The frequency weighted mean age of participants was 43.2 years, and 52.7% were female. The follow-up period ranged from 2 weeks to 6 months. Nine of the studies assessed pain using the visual analog scale (VAS),[12,13,15–19,22,23] whereas only 3 studies reported pain using the numeric rating scale (NRS).[14,20,21] Seven of the studies assessed disability using the Oswestry pain and disability index (ODI),[14,15,18–22] three studies used Roland-Morris Disability Questionnaire (RMDQ),[12,13,16] and only 1 study used Oswestry Physical Disability Questionnaire (OPDQ).[23] A detailed description of all included studies can be found in Table 1.

3.2. Methodologic quality assessment

The critical appraisal of the included trials using the Cochrane risk of bias tool is detailed in Figure 2A and summarised using a stacked bar chart in Figure 2B. Allocation concealment was adequately reported by Added et al,[12] except in 11 studies where the concealment of allocation from the investigators was unclear (unclear risk of bias).[13–23] All of 12 trials failed to blind both the therapists and participants.[12–23] Among trials included in this review, all trials described clear inclusion and exclusion criteria. Adequate random sequence generation was reported in 10 trials.[12,14–20,22,23] The outcome assessors were blinded in only 3 studies.[12,16,17] Trial registration number or study protocol was available for 1 trial. The proportion of patients lost to follow-up was <20% in all studies, indicating low attrition bias. All studies did report results of all predefined measures, indicating low

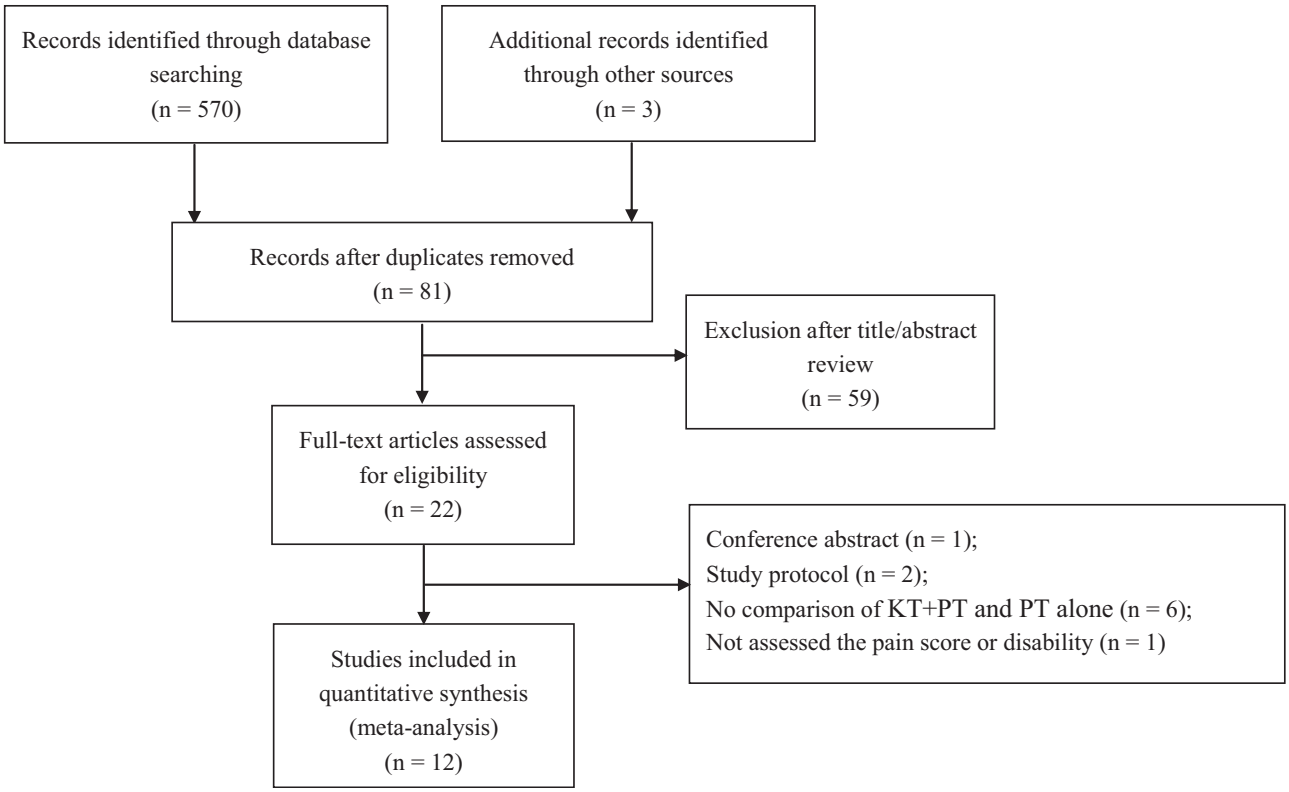

Figure 1. PRISMA Flow diagram describing the selection process for relevant clinical trials used in this meta-analysis.

Table 1

Study characteristics and patient demographic details.

Study	Design	No. (KT + PT, PT)	Female (KT + PT, PT)	Mean age (KT + PT, PT)	Intervention (KT + PT)	Control (PT)	Outcomes
Added 2016	RCT	74, 74	53, 53	45.6, 44.6	KT: lasting for 5 weeks, 3 months, and 6 months; PT: exercise and manual therapy, lasting for 5 weeks, 3 months, and 6 months	PT: exercise and manual therapy, lasting for 5 weeks, 3 months, and 6 months	VAS, RMDQ
Azab 2020	RCT	14, 15	NR	11.8, 12.1	KT: two I-shaped tapes, lasting for 3 months; PT: 30-minute exercise program, three times per week, lasting for 3 months	PT: 30-minute exercise program, three times per week, lasting for 3 months	VAS
Kachanathu 2014	RCT	20, 20	10	34.8	KT: two I-shaped tapes, lasting for 4 weeks; PT: 30-minute exercise program, three times per week, lasting for 4 weeks	PT: 30-minute exercise program, three times per week, lasting for 4 weeks	VAS, RMDQ, ROM
Kamali 2018	RCT	21, 21	11, 10	27.1. 25.1	KT: two bands of 5-cm KT, lasting for 4 weeks; PT: manual therapy, one a day, lasting for 4 weeks	PT: manual therapy, one a day, lasting for 4 weeks	NRS, ODI
Koroglu 2017	RCT	20, 20	12, 8	47.2, 47.9	KT: two bands of 5-cm KT, lasting for 4 week; PT: exercise and manual therapy, lasting for 4 weeks	PT: exercise and manual therapy, lasting for 4 weeks	VAS, ODI
Paoloni 2011	RCT	13, 13	8, 9	62, 62.7	KT: three bands of 5-cm KT, lasting for 4 week; PT: exercise and manual therapy, three times per week, lasting for 4 weeks	PT: exercise and manual therapy, three times per week, lasting for 4 weeks	VAS, RMDQ
Peng 2015	RCT	23, 23	10, 11	37.5, 36.1	KT: Y-shaped Kinesio type, three days/time, lasting for 3 weeks; PT: ultrasound treatment, once a day, lasting for 3 weeks	PT: ultrasound treatment, once a day, lasting for 3 weeks	VAS, ODI
Senbursa 2020	RCT	24, 22	12, 11	45.3, 42.1	KT: lasting for 4 weeks and 8 weeks; PT: stabilization exercises, lasting for 4 weeks and 8 weeks	PT: stabilization exercises, lasting for 4 weeks and 8 weeks	VAS, ODI
Song 2016	RCT	50, 50	23, 21	41.2, 38.8	KT: Y-shaped Kinesio type, one a day, lasting for 3 weeks; PT: acupuncture therapy, once a day, lasting for 3 weeks	PT: acupuncture therapy, once a day, lasting for 3 weeks	NRS, ODI
Su 2015	RCT	20, 20	7, 9	NS	KT: two I-shaped tapes, once a day, lasting for 2 weeks and 4 weeks; PT: tuina therapy, electrotherapy, and manual therapy, lasting for 2 weeks and 4 weeks	PT: tuina therapy, electrotherapy, and manual therapy, lasting for 2 weeks and 4 weeks	NRS, ODI, ROM
Xu 2018	RCT	30, 30	16, 14	45.1, 45.2	KT: Y-shaped Kinesio type, one a day, lasting for 2 weeks; PT: tuina therapy and electrotherapy, lasting for 2 weeks	PT: tuina therapy and electrotherapy, lasting for 2 weeks	VAS, OPDQ
Zhuang 2019	RCT	30, 29	17, 16	69.2, 68.1	KT: three times per week, lasting for 2 weeks and 4 weeks; PT: electrotherapy, three times per week, lasting for 2 weeks and 4 weeks	PT: electrotherapy, three times per week, lasting for 2 weeks and 4 weeks	VAS, ODI

KT = kinesio taping, NRS = Numerical rating scale, ODI = Oswestry pain and disability index, OPDQ = Oswestry physical disability questionnaire, PT = physical therapy, RCT = randomized controlled trial, RMDQ = Roland-Morris Disability Questionnaire, VAS = Visual Analogue Scale.

reporting bias. None of other bias was detected. The overall kappa value regarding the evaluation of risk of bias was 0.814, meaning an excellent degree of agreement between the two reviewers.

3.3. Quantitative analysis and GRADE summary

A meta-analysis of 12 trials[12–23] comparing patients treated with KT + PT versus PT alone showed that the pain intensity reduction in the KT + PT group was significantly greater than that in the PT group for at least 2 weeks after initial treatments (SMD, 0.73 [95% CI, 0.37–1.08], $P < .00001$) (Fig. 3). The I^2 statistic for pain intensity reduction was 78%, suggesting that moderate to high heterogeneity may be present. A meta-analysis of 11 studies[12–16,18–23] comparing patients treated with KT + PT versus PT alone showed that the disability reduction in the KT + PT group was significantly greater than that in the PT group for at least 2 weeks after initial treatments (SMD, 1.01 [95% CI, 0.42–1.59], $P = .0007$) (Fig. 4). The I^2 statistic for disability reduction was 91%, suggesting that high heterogeneity may be present. The GRADE system was used to evaluate the quality of outcomes in this study. The quality of evidence regarding the outcomes was low. The factors that lowered the quality

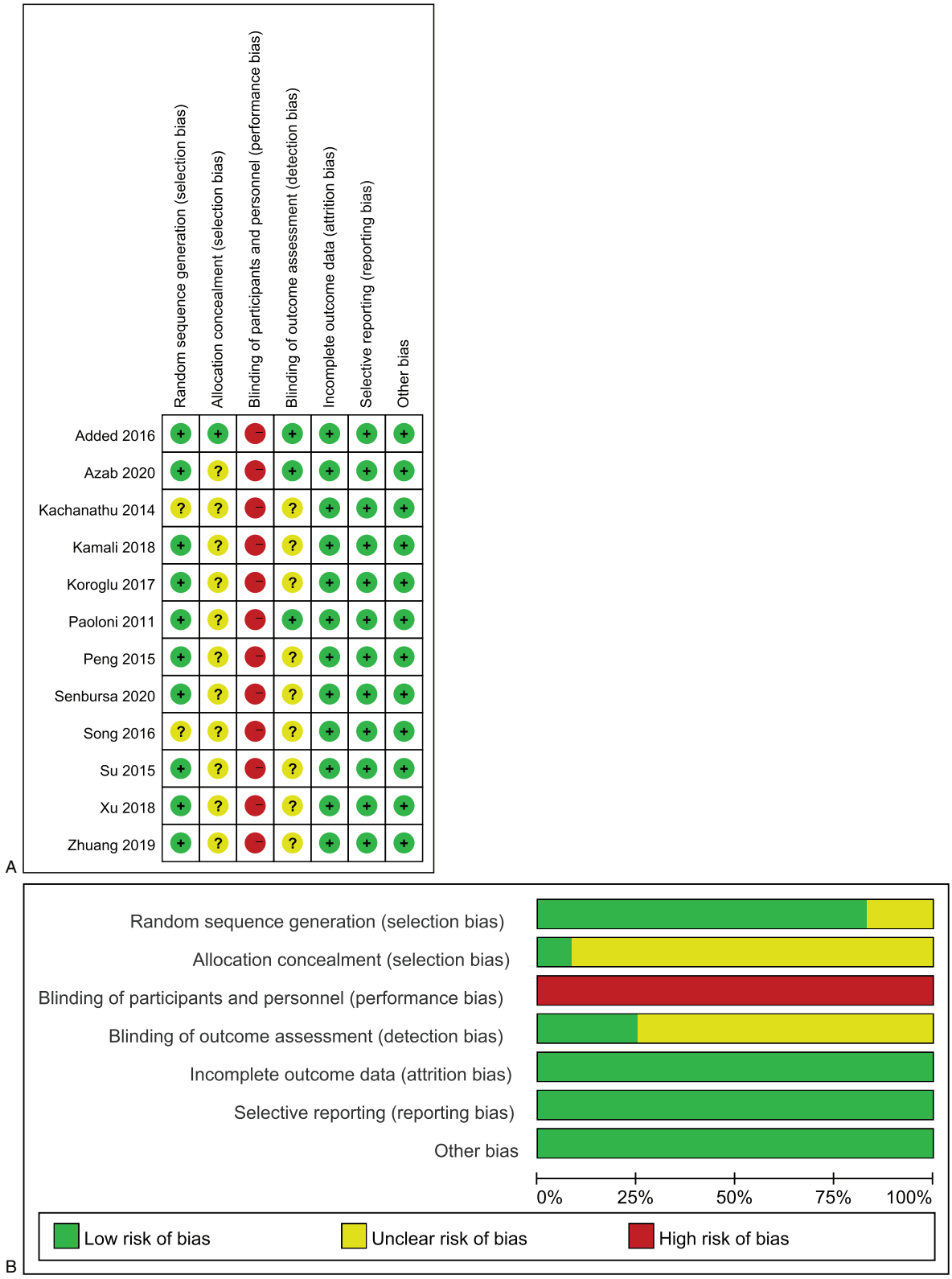

Figure 2. (A) Risk of bias summary; (B) risk of bias graph.

according to the GRADE were the high statistical heterogeneity, and the unclear risk of selection, and the high risk of performance bias. The details of the results are summarized in Table 2.

3.4. Subanalysis and sensitivity analysis

3.4.1. Subanalysis on outcome of pain intensity reduction.

Of the 12 studies that utilized pain scores,[12–23] 9 studies[12,13,15–19,22,23] reported VAS scores and 3 studies reported NRS

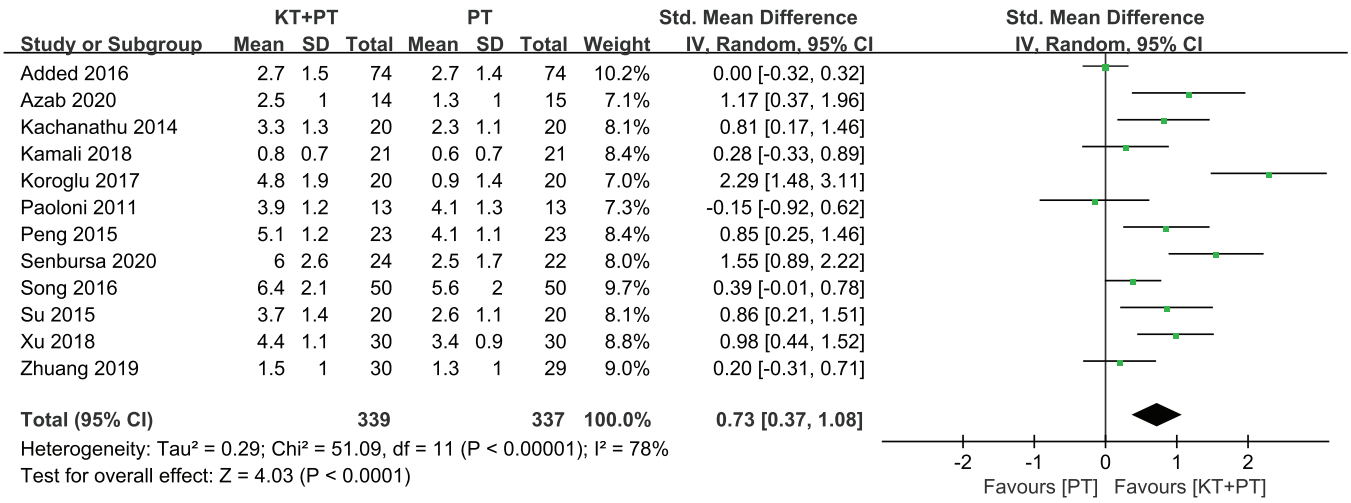

Figure 3. Forest plots of the pain intensity reduction between KT + PT group and PT group after CLBP.

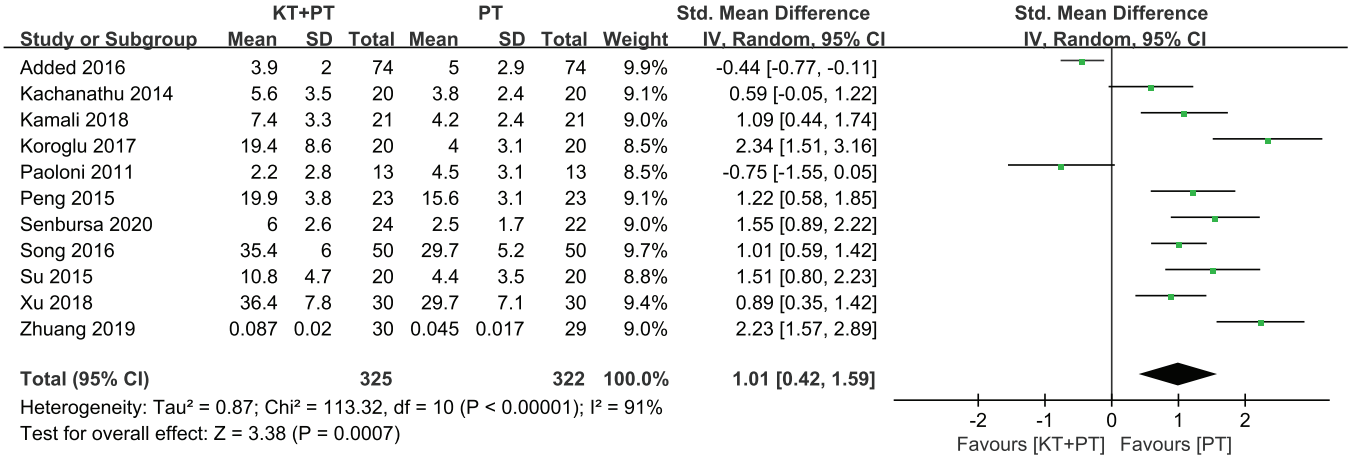

Figure 4. Forest plots of the disability reduction between KT + PT group and PT group after CLBP.

scores.[14,20,21] All 12 studies reporting on pain intensity reduction found KT + PT patients to improve significantly from baseline to final follow-up. When comparing KT + PT and PT patients at latest follow-up, 7 of the possible 12 outcome scores (58.3%) demonstrated significant improvement in patients undergoing treatment with KT + PT when compared with PT, while none (0%) demonstrated superiority with PT.[13,15,17–20,23]

3.4.2. Subanalysis on outcome of disability reduction. Of the 11 studies that assessed disability,[12–16,18–23] 7 studies reported ODI scores,[14,15,18–22] 3 studies reported RMDQ scores,[12,13,16] and 1 study utilized OPDQ scores.[23] All 7 studies reporting on ODI scores, 2 of the 3 studies reporting on RMDQ scores, and 1 study reporting on OPDQ scores found KT + PT patients to improve significantly from baseline to final follow-up. When comparing KT + PT and PT patients at latest follow-up, 8 [14,15,18,19–23] of the possible 11 outcome scores (72.7%) demonstrated significant improvement in patients undergoing treatment with KT + PT when compared with PT, while only 1 of the possible 11 outcome scores (9.1%) demonstrated superiority with PT.

Table 2

GRADE summary of findings.

Summary of results				Quality of the evidence (GRADE)				
Outcomes	**Participants (trials), n**	**SMD (95% CI)**	***P***	**Design**	**Inconsistency**	**Indirectness**	**Imprecision**	**Quality**
Pain intensity reduction	676 (12)	0.73 (0.37 to 1.08)	<.00001	Limitations*	Yes†	No	No	Low ●● ○○
Disability reduction	647 (11)	1.01 (0.42 to 1.59)	.0007	Limitations*	Yes†	No	No	Low ●● ○○

GRADE = Grading of Recommendations Assessment, Development and Evaluation; SMD = standard mean difference.
* Lack of blinding of participants and personnel.
† Large statistical heterogeneity, $I^2 > 75\%$.

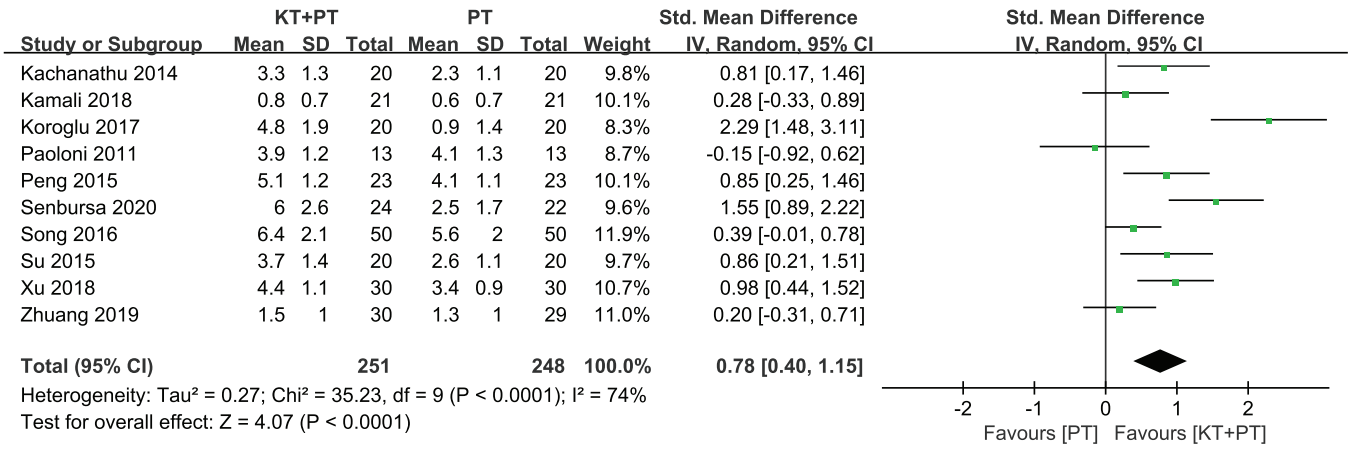

Figure 5. Forest plots of the pain intensity reduction between KT + PT group and PT group after CLBP between 2 weeks and 4 weeks.

3.4.3. Sensitivity analysis based on follow-up periods. Of the 12 studies that assessed pain intensity reduction, 10 studies reported pain intensity reduction between 2 weeks and 4 weeks, and 2 studies reported pain intensity reduction over 3 months.[12,17] The result was not changed when the studies of Added et al[12] and Azab et al[17] were removed (SMD, 0.78 [95% CI, 0.40–1.15], $P < .00001$) (Fig. 5). Of the 11 studies that assessed disability, 9 studies reported disability reduction between 2 weeks and 4 weeks, and 1 study reported disability reduction over 3 months. The result was not changed when the study of Added et al was removed (SMD, 1.17 [95% CI, 0.71–1.62], $P < .00001$) (Fig. 6).

3.5. Publication bias

The funnel plot of disability reduction was symmetrical, indicating a low risk of publication bias (Fig. 7A). However, there were significant publication biases in the funnel plot of pain intensity reduction (Fig. 7B). After trimming by imputing the missing studies, adding them to the analysis, and then recomputing the effect size, the SMD did not changed significantly.

4. Discussion

The most important finding of the present study showed that the therapeutic effect of PT combined with KT provided superior effects on pain and disability scores for at least 2 weeks after initial treatments compared with the PT alone. The level of evidence of outcomes was low, indicating that the degree of benefit must be studied although the benefit is conclusive.

CLBP is due to abnormal short or prolonged stresses that affect the muscular components of the lumbar and pelvic regions. Muscle imbalances of the lumbopelvic region, as a result of repetitive injury or physical stress, may contribute to the lengthening and weakening of the phasic muscles, while the postural muscles (antigravity) become tight and overactive. Hypertonic postural muscles can lead to ischemia and reduced blood circulation, further aggravating pain. This imbalance modifies body movement, putting strain on muscles, tendons, ligaments, and joints; consequently, the end result is often CLBP. Although the mechanism through which KT acts on musculoskeletal conditions is not yet clear, it is hypothesized that KT applies pressure to the skin or stretches the skin and that this external load may stimulate cutaneous mechanoreceptors (large

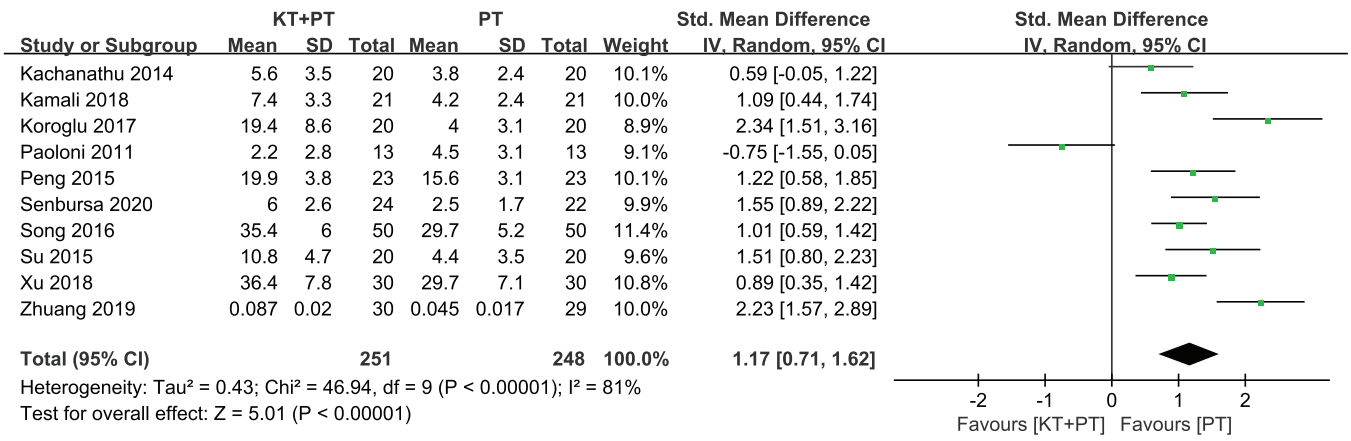

Figure 6. Forest plots of the disability reduction between KT + PT group and PT group after CLBP between 2 weeks and 4 weeks.

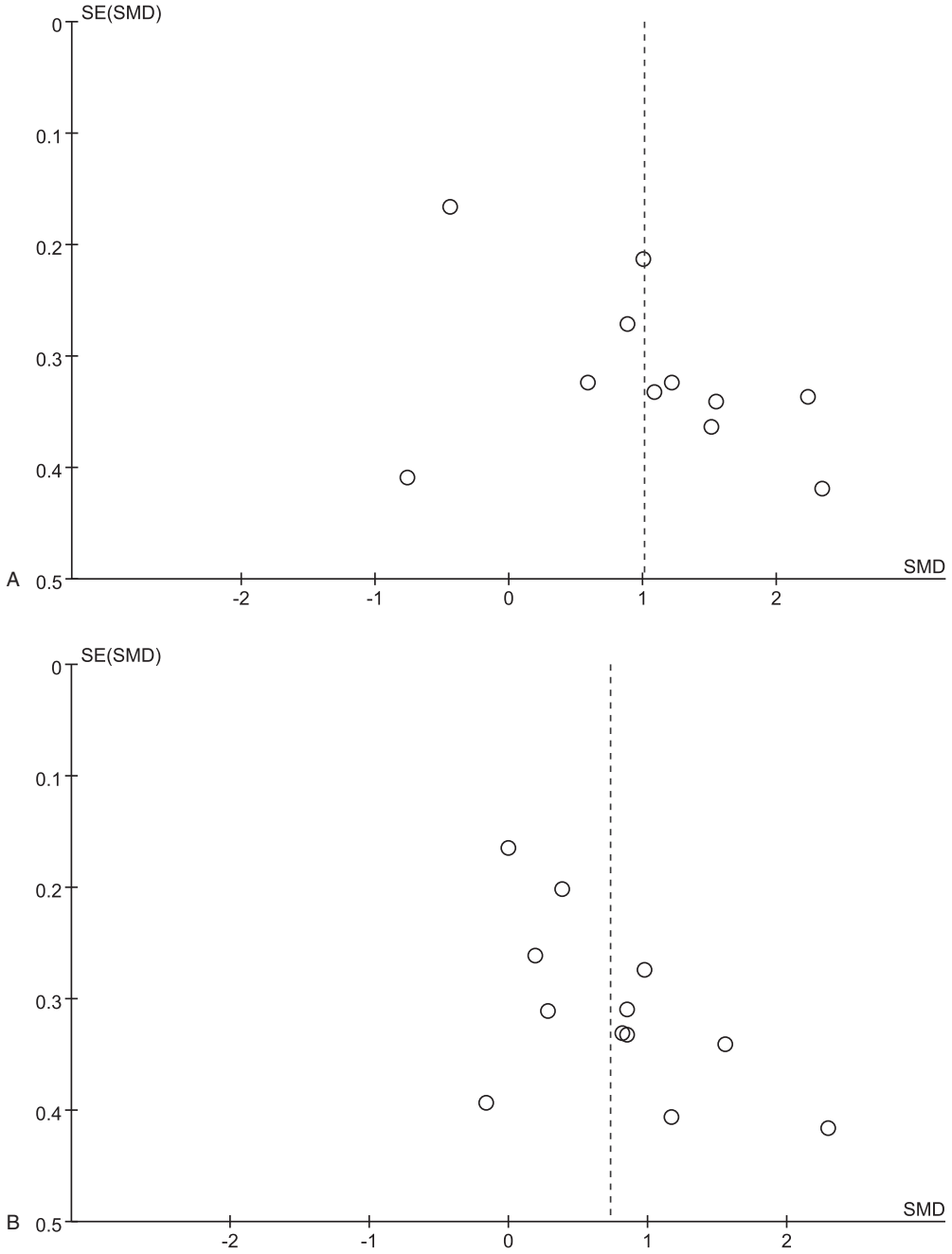

Figure 7. (A) Funnel plot of publication bias for the disability reduction between KT + PT group and PT group after CLBP. There was symmetry, suggesting that there was not a significant publication bias; (B) Funnel plot of publication bias for the pain intensity reduction between KT + PT group and PT group after CLBP. There was not symmetry, suggesting that there was a significant publication bias.

myelinated fibers) and thus inhibit pain transmission according to the gate control theory.

Numerous reviews and meta-analyses have been published comparing the efficacy of KT in individuals with CLBP. In a meta-analysis that included 10 randomized controlled trials, Li et al showed that KT was not superior to placebo taping for pain relief, but could significantly improve disability when compared to the placebo taping.[24] Sheng et al included 8 studies to compare placebo taping with KT and found that significant differences in mean pain level and disability, reporting that KT may be a new, simple and convenient choice for intervention in low back pain.[9] However, the other 2 meta-analysis showed that KT was no better than any other intervention for most the outcomes assessed in patients with CLBP.[10,11]

The findings from our meta-analysis were not in line with findings from a previous meta-analysis.[10] These differences resulted from limited studies included in their analysis. The authors showed that there were no significant differences for pain intensity and disability between KT + PT and PT alone groups, and thus concluded that there was no evidence to support the use of KT in clinical practice for patients with CLBP. However, compared to 12 studies with 676 patients in our study, only 5 studies with relatively small sample size (396 patients) was included in their meta-analysis,[12–16] which might not powerful

to discover the statistical differences between the two techniques. In addition, adequate subgroup analyses and sensitivity analyses were not performed in their study.

Several limitations of the meta-analysis should be noted. First, some important outcomes were not evaluated, such as range of motion and distance walked. However, there was a paucity of studies on these functional assessment tools; thus, it was difficult to perform further analyses. Second, the total quality of included studies was rated as moderate, and overall confidence in the outcomes was low, which may lead to overestimation of effect and reduction in the recommendation rate of our pooled results. Third, heterogeneity among the included studies was unavoidable due to the different regimens of KT and PT used. Heterogeneity was also caused by a variety of other factors, such as racial differences and age differences. Therefore, SMD and random-effect model were used to evaluate some outcomes in our meta-analysis. Finally, despite 12 studies were included in this meta-analysis, there is a need for more high-quality RCT studies with large sample sizes to confirm the reliability of the present study. Despite these limitations, the study demonstrated a clear comparison of therapeutic effects between PT combined with KT and PT alone for the treatment of CLBP.

Continued research in this area is needed, specifically as newer, and possibly safer interventions become available. Future directions should focus on the cost-effectiveness the use of KT in CLBP as well as the adverse effects.

5. Conclusions

Kinesio taping combined with physical therapy provided better therapeutic effects regarding pain reduction and disability improvement compared with physical therapy alone in individuals with chronic low back pain.

Author contributions

Funding acquisition: Qiliang Lou.
Methodology: Qiliang Lou.
Project administration: Qiliang Lou.
Writing – original draft: Guangchen Sun.
Writing – review & editing: Qiliang Lou.

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