REVIEW ARTICLE

Effects of Kinesio Taping for Chronic Nonspecific Low Back Pain: A Systematic Review and Meta-analysis

Li Pan, PhD; Yafang Li, MM; Lei Gao, MM; Yao Sun, MM; Miaomiao Li, MM; Xiaocui Zhang, MM; Yue Wang, PhD; Baoxin Shi, PhD

ABSTRACT

Context • Chronic nonspecific low back pain (CNLBP) is a common musculoskeletal disorder that seriously affects patients' quality of life (QoL). Clinicians have used Kinesio Taping (KT) in the treatment of CNLBP patients, but evidence is still lacking on the benefits of KT for CNLBP.

Objective • The study aimed to perform a systematic review and meta-analysis of the currently published randomized controlled trails (RCTs) to determine KT's efficacy for CNLBP patients.

Design • The research team performed a literature search using five major electronic databases—PubMed, Embase, Web of science, Cochrane Library, MEDLINE and OpenGrey—and included studies form inception to January 2018. The search used the keywords "kinesio tap*", "kinesio*", and "chronic low back pain (CLBP)" or "CNLBP".

Setting • The study took place in the 942 Hospital of the Joint Logistics Support Force of the Chinese People's Liberation Army.

Outcome Measures • The research team performed the meta-analysis using RevMan 5.3 software. The team selected studies that used pain intensity and disability as the primary outcome measures, and if the study used other outcomes, they had to be the secondary outcomes.

Results • The systematic review included nine RCTs in the meta-analysis. KT can significantly reduce pain intensity between baseline and immediately postintervention (SMD = -0.47, 95% CI -0.93 to -0.02, $P = .04$) and between baseline and the short-term follow-up period (SMD = -0.67, 95% CI -0.44 to -0.20, $P = .03$). However, no significant differences existed between KT's ability to relieve other symptoms of CNLBP—disability, trunk flexion range of motion (ROM), change in status, fear of movement, isometric endurance of the trunk muscles, or extension—when compared to either sham taping or KT as an adjunct to physical therapy.

Conclusions • KT can have immediate and short-term positive effects on reducing pain intensity, but existing evidence doesn't support KT's superiority to other interventions in improving functions for individuals with CNLBP. (*Altern Ther Health Med.* 2023;29(6):68-76).

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Low back pain (LBP) can affect numerous aspects of an individual's life and is associated with high costs for patients and society.[1] For the more than 80% of LBP patients who have no pathological anatomical cause for pain, *The European Guidelines for the Management of Chronic Nonspecific Low Back Pain* defines them as suffering from nonspecific LBP (NLBP), which refers to symptoms associated with pain in the back's lower region that lasts for at least 12 weeks.[2]

Clinicians commonly use several interventions to decrease pain intensity, disability, and social burden for CNLBP patients, such as exercise, pharmacological therapy,

and education.[3,4] Nonetheless, the effects of these interventions are mild to moderate. Therefore, patients need more effective treatments for CNLBP.

In the 1970s, Kase et al developed KT.[5] Comeau-Gauthier and Khan indicated that its underlying mechanisms are: (1) aiding muscle and positional stimulus through the skin, aligning connective tissues; (2) lifting the soft tissues above the area of pain or inflammation to create more space; (3) activating blood and lymph circulation; and (4) providing mechanical support and sensory stimulation.[6]

Now, KT has become a common intervention for patients with LBP, but evidence is still lacking on the benefits of KT for CNLBP. The conclusions of systematic reviews and meta-analyses published on its effects are inconsistent. Also, previously published systematic reviews and meta-analyses have other limitations.[7-15] For instance, participants in the included studies didn't have a single condition, nor did they also suffer from other diseases. Furthermore, the participants of the included studies had similar symptoms, such as LBP, but different etiologies. What's more, the studies didn't cover KT's middle- and long-term follow-up effects.

The current study aimed to perform a systematic review and meta-analysis of the currently published randomized controlled trails (RCTs) to determine KT's efficacy for CNLBP patients.

METHODS

Procedures

The study took place in the 942 Hospital of the Joint Logistics Support Force of the Chinese People's Liberation Army. The research team registered the study in the International Prospective Register of Systematic Reviews (PROSPERO), with the registration number of CRD42018103430.

Search strategy. The research team performed a literature search using five major electronic databases—PubMed, Embase, Web of science, Cochrane Library, MEDLINE and OpenGrey—and included studies from the databases' inceptions to January 2018. The search used the keywords "kinesio tap*", "kinesio*", and "chronic low back pain (CLBP)" or "CNLBP" in "title, abstract, keyword." The team also searched the references of the retrieved articles. The review included only articles published in the English language.

Inclusion criteria. The research team included studies in this review if they: (1) had included participants that were 18 years of age or older who had received a diagnosis of CNLBP that had been at least 12 weeks in duration; (2) had been RCTs; (3) had used KT interventions with or without standardized co-interventions, or if they had used co-interventions, they had to be equal to both the intervention and control groups that apply KT at any times or for any length of time, and (4) had not considered the types of outcome measures as part of the eligibility criteria; and (5) used pain intensity and disability as the primary outcome measures, and if the study used other outcomes, they had to be the secondary outcomes. The research team excluded animal studies, cohort studies, case reports, case-control studies, and review articles.

Data-extraction process. Two reviewers independently performed the data extraction using a standardized form. The data extracted from the selected articles included: (1) author's name; (2) publication date; (3) participants' characteristics, such as age and gender; (4) brief details about the intervention; (5) outcome measures; if a study reported more than one instrument or measure of one outcome, the meta-analysis considered only one; (6) the results at baseline, postintervention, and at every reported follow-up; and (7) conclusions.

The reviewers recorded follow-up data using three time periods: (1) short-term—less than or equal to 3 months after randomization, (2) medium-term—more than 3 months and less than 12 months, and (3) long-term—12 months or more. If a study presented more than one follow-up set of data for an outcome measure for the same follow-up period, the review considered only one.

Methodological quality assessment. The research team assessed the methodological quality of the trials using the PEDro scale, which is a reliable measurement for evaluating the quality of clinical trials.[16] The PEDro scale consists of a checklist of 10 scored yes-or-no questions pertaining to a study's internal validity and statistical information provided. It considers 6-10 = high quality, 4-5 = fair quality, and ≤ 3 = poor quality. The reviewers used this scale to identify the studies' categories, but didn't exclude studies on the basis of quality.

Statistical Analysis

The research team used Review Manager 5.3, 2014 (Cochrane Collaboration, Haymarket, London, United Kingdom) to conduct the meta-analyses: (1) calculated standardized mean differences (SMDs) or mean differences (MDs) with 95% confidence intervals (95%CI) for continuous variables; (2) used the SMDs to account for differing outcome scales used in different studies; (3) used Cohen as a guide to identifying small (0.20), medium (0.50), and large (0.80) effects calculated with SMDs[14]; (4) used the I^2 statistic to measure heterogeneity, and used the fixed effects model when the $I^2 < 50\%$ and otherwise used the random effects model; and (5) performed subgroup analyses based on the intervention or control group's strata to make the results more comparable.

For example, the research team define the studies: (1) in which the participants in the intervention group received KT while those in the control group received sham taping as "only KT versus minimal intervention," and (2) in which the participants in the intervention group received KT and physical therapy while those in the control group received physical therapy only as "KT + physical therapy versus physical therapy."

The research team calculated differences such that negative differences indicated that the results were beneficial to the intervention group—KT or KT + physical therapy, while positive differences indicated that the results were beneficial to the control group—sham taping or physical therapy only. $P < .05$ indicated significant differences for all analyses.

Table 1. Included Studies

Author, Year, Country	Intervention	Characteristics of Participants				Group	Outcome Measures and Follow-up	Group	Results				Conclusions
		Sample	PEDro	Gender M:F	Age, y				Baseline	Immed Postinterv	Short-term Follow up	Intermed.-term Follow-up	
Luz,[23] 2015, Brazil	KT application over the erector spinae muscle with 10-15% tension in the stretched position Study's Duration: 48h Taping duration: 48h Follow-up at 7 d	N= 60, 20 in each group	Interv Control Placebo	19:41	44.3 (15.0) 50.1 (17.5) 48.1 (13.4)	Interv Control Placebo	Pain intensity: Pain numeric rating scale	Interv Control Placebo	6.6 (1.2) 6.7 (1.6) 6.1 (2.1)	4.9 (2.6) 5.1 (2.7) 5.4 (2.6)	5.8 (1.3) 6.3 (2.0) 5.5 (1.9)		The KT intervention was superior for the disability outcome only when compared to the control group at the 48-hour assessment, suggesting that clinicians should avoid this type of therapy.
			Interv Control Placebo				Disability: Roland Morris Disability Questionnaire (RMDQ)	Interv Control Placebo	12.8 (5.6) 12.2 (6.5) 11.8 (6.5)	8.6 (5.6) 9.4 (6.7) 10.6 (6.9)	9.6 (5.6) 10.2 (7.4) 10.3 (6.6)		
Added,[19] 2016, Brazil	Physical therapy + KT and physical therapy only: General exercise and manual therapy and specific exercises to strengthen the lumbar spine Taping renewal: 48 h Duration: 5 wks Follow up at 3 and 6 mos	N=148, 74 in each group	8	42:106	45.1 (11.6)		Pain intensity: Numeric pain rating scale	Interv Control	7.55 (1.76) 7.40 (1.69)	4.68 (3.00) 4.70 (2.77)	5.59 (2.76) 5.91 (2.84)	5.74 (3.10) 5. 67 (2.98)	The physical therapy program consisting of exercise and manual therapy didn't get any additional benefit from the use of KT.
							Disability: Roland Morris Disability Questionnaire (RMDQ)	Interv Control	12.97 (5.57) 14.07 (5.95)	10.6 (6.9) 9.07 (7.56)	10.6 (6.9) 9.46 (7.96)	10.3 (6.6) 9.51 (7.67)	
							Change in status: Global perceived effect scale	Interv Control	-1.85 (3.05) -1.28 (2.88)	2.30 (3.00) 2.74 (2.34)	1.68 (3.18) 1.60 (3.17)	0.83 (3.58) 1.15 (3.15)	
Al-Shareef 2016, Saudi Arabia[17]	Bilateral erector spine I-shape taping with 10%-15% tension, applied on para-vertebral muscles. Taping renewal twice a week Duration: 2 wks Follow up at 4 wks	N=40, 20 in each group	7	20:20	37.55 (9.82) 35.55 (8.04)	Interv Control	Pain intensity: Visual Analog Scale	Interv Control	5.90 (1.20) 6.45 (0.75)	2.65 (1.46) 5.25 (0.25)	2.15 (1.18) 4.95 (0.79)		KT reduces pain and disability and improves trunk flexion ROM after 2 weeks of application.
							Disability: Oswestry Disability Index (ODI)	Interv Control	20.70 (7.73) 21.60 (6.54)	11.95 (6.15) 16.75 (5.86)	10.0 (4.83) 16.5 (5.72)		
							Trunk flexion ROM: Modified Schober's test (MST)	Interv Control	4.42 (0.40) 4.20 (0.61)	6.27 (0.41) 5.31 (0.68)	6.27 (0.41) 5.31 (0.68)		
Araujo 2018, Portugal[20]	KT over each erector spinae muscle with 10 to 15% tension. Duration: 4 wks Follow-up at 6 mos	N=148, 74 in each group	7	Not reported	Not reported		Pain intensity: 0 to 10 Numerical Rating Scale	Interv Control	7.0 (2.0) 6.8 (2.0)			5.2 (3.0) 5.8 (2.6)	Four weeks of KT treatment was no better than sham taping for patients with CLBP, at 6 month follow-up
							Disability: Roland Morris Disability Questionnaire (RMDQ)	Interv Control	11.5 (6.2) 10.4 (5.3)			8.8 (7.4) 8.9 (6.7)	
							Change in status: Global impression of recovery, Global Perceived Effect scales	Interv Control	-1.0 (3.2) -0.1 (2.9)			0.3 (3.4) 0.8 (2.9)	
Bae, 2013, Korea[21]	Ordinary physical therapy + four blue "I" strips stretched and overlapping, attached to the lumber area with the maximum pain in a star shape. Duration: 12 wks	N=20, 10 in each group	6	9:11	53.6 (2.1) 51.3 (3.7)	Interv Control	Pain intensity: Visual analogue scale	Interv Control	7.83 (0.38) 7.71 (0.61)	5.07 (0.78) 5.14 (0.95)			KT reduced pain and positively affected anticipatory postural control and MRCP.
							Disability: Oswestry Disability Index (ODI)	Interv Control	16.32 (5.13) 15.43 (4.34)	10.75 (4.73) 11.34 (3.32)			
Castro-Sanchez 2012, Spain[18]	KT standardized application in sitting position, with four blue I-strips placed at 25% tension and overlapping in a star shape over the point of maximum pain in the lumbar area. Duration: 1 wk Follow-up at 1 mo.	N=59, 30 in intervention group, 29 in control group	9	19:40	50 (15) 47 (13)	Interv Control	Pain intensity: 0 to 10 Numerical Rating Scale	Interv Control	5.6 (1.8) 5.4 (1.3)	4.2 (1.4) 5.1 (1.4)	4.7 (1.4) 5.6 (1.4)		KT reduced disability and pain, but these effects may have been too small to be clinically worthwhile.
							Disability: Roland Morris Disability Questionnaire (RMDQ and Oswestry Disability Index (ODI)	Interv Control	10.9 (2.1) 9.8 (2.9)	9.5 (2.1) 9.6 (3.0)	9.8 (2.2) 8.6 (3.0)		
							Trunk flexion ROM: Fleximeter	Interv Control	94 (7) 90 (9)	98 (7) 92 (11)	97 (7) 94 (8)		
							Fear of movement: Tampa Scale for Kinesophobia	Interv Control	41 (3) 39 (5)	39 (4) 38 (4)	39 (3) 38 (4)		
							Isometric endurance of the trunk muscles: McQuade test	Interv Control	41 (18) 49 (19)	54 (16) 39 (20)	49 (17) 39 (18)		
Kachanathu, 2014, Egypt[22]	Conventional physical therapy + KT Taping Renewal three times per week Duration: 4 wks	N=40, 20 in each group	6	30:10	34.8 (7.54)	Interv Control	Pain intensity Visual analogue scale	Interv Control	6.1 (1.4) 6 (1.8)	2.9 (1.4) 3.7 (2)			A physical therapy program involving strengthening exercises for abdominal muscles and stretching exercises for back, hamstring, and iliopsoas muscles, with or without KT, was beneficial in the treatment of CLBP.
							Disability: Roland Morris Disability Questionnaire (RMDQ)	Interv Control	10.3 (3.21) 10.8 (5)	4.7 (2.9) 7 (5.5)			
							Trunk flexion ROM: Modified Schober's test	Interv Control	6 (1.1) 6.3 (1.1)	6.4 (1.2) 6.6 (1)			
							Extension: Modified Schober's test	Interv Control	1.4 (0.6) 1.4 (0.5)	1.7 (0.6) 1.63 (0.4)			
Parreira, 2014, Brazil[10]	I-shaped KT over each erector spinae muscle with 10 to 15% tension Renewal of taping: twice per week Duration: 4 wks Follow-up at 12 wks	N=148, 74 in each group	9	33:115	51 (15) 50 (15)	Interv Control	Pain intensity: 0 to 10 Numerical Rating Scale	Interv Control	7.0 (2.0) 6.8 (2.0)	4.4 (2.8) 4.6 (2.5)	5.4 (2.4) 5.7 (2.5)		KT applied with stretch to generate convolutions in the skin was no more effective than simple application of the tape without tension.
							Disability: Roland Morris Disability Questionnaire (RMDQ)	Interv Control	11.5 (6.2) 10.4 (5.3)	8.3 (6.9) 7.4 (6.4)	8.8 (7.5) 7.4 (6.3)		
							Change in status: Global impression of recovery, Global Perceived Effect scale	Interv Control	-1.0 (3.2) -0.1 (2.9)	2.4 (2.4) 1.9 (2.7)	1.2 (2.8) 1.6 (2.5)		
Preece, 2017, United Kingdom[24]	Two "I" bilaterally along the paravertebral muscles 10-15% tension from the backing paper	N=34, 20 in intervention group, 14 in control group	8	34:0	42 (11)		Trunk flexion ROM: Modified Fingertip to Floor Technique (MFTTF)	Interv Control	26.83 (10.95) 28.18 (11.39)	24.08 (11.05) 26.60 (9.94)			KT demonstrated an immediately positive effect on trunk flexion when compared with baseline measurements. However, the results suggest that KT performs no better than a comparable placebo.

Abbreviations: CLBP, chronic nonspecific low back pain; Immed Postinterv, immediately postintervention; Intermed-term, intermediate term; Interv, intervention; KT, Kinesio Tape; MRCP, movement-related cortical potential; ROM, range of motion.

Table 2. PEDro Score. Score of 1 = criteria met; 0 = unmet

Item	Score	Luz, 2015[23]	Added, 2016[19]	Al-Shareef, 2016[17]	Araujo, 2018[20]	Bae, 2013[21]	Castro-Sánchez, 2012[18]	Kachanathu, 2014[22]	Parreira, 2014[10]	Preece, 2017[24]
Random allocation of participants to groups; in a crossover study, random allocation in the order in which participants received treatments	0/1	1	1	1	1	1	1	1	1	1
Concealed allocation	0/1	1	1	1	1	0	1	0	1	1
Similar groups at baseline regarding the most important prognostic indicators	0/1	1	1	1	1	1	1	1	1	1
Blinding of all participants	0/1	0	0	0	0	0	1	0	1	1
Blinding of all therapists who administered the therapy	0/1	0	0	0	0	0	0	0	0	0
Blinding of all assessors who measured at least one key outcome	0/1	0	1	1	1	0	1	0	1	1
Measurement of at least one key outcome for more than 85% of the participants initially allocated to groups	0/1	1	1	1	1	1	1	1	1	1
Receipt of treatment or control condition as allocated for all participants for whom outcome measures were available, or where not the case, analysis of data for at least one key outcome by intention to treat	0/1	1	1	0	0	1	1	1	1	1
Results of between-group statistical comparisons for at least one key outcome	0/1	1	1	1	1	1	1	1	1	1
Provision of both point measures and measures of variability for at least one key outcome	0/1	1	1	1	1	1	1	1	1	1
Mean ± SD	7.4 ± 1.13	7	8	7	7	6	9	6	9	8

RESULTS

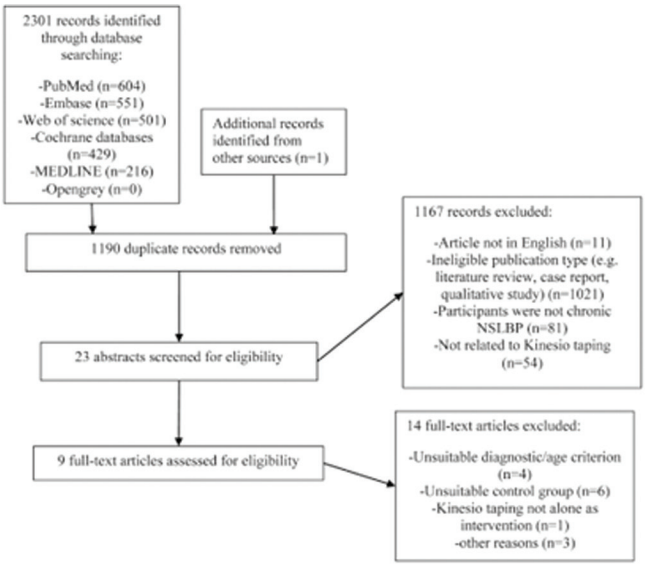
Search Results

Figure 1 presents the screening process. The research team obtained 2301 articles through the preliminary search of the databases. After removing duplicates and screening titles and abstracts for eligibility, 1190 articles remained, and the reviewers excluded 1167 on them. The reviewers then assessed 22 abstracts to verify articles' eligibility for inclusion plus one additional study obtained from reading their references. The reviewers screened the remaining 14 full-text articles for eligibility, excluding five articles, and selected nine studies for the current review (Table 1).[10,17-24]

Table 2 shows that the PEDro scale found a mean score of 7.4 ± 1.13, with a range from 6 to 9. The unmet criteria commonly were concealment of allocation and blinding of physical therapists and patients.

The researchers had conducted the nine included studies in Europe—United Kingdom, Spain, and Portugal, the Middle East—Egypt and Saudi Arabia, Australia, South America—Brazil, and Asia—Korea and published them between 2012 and 2016. The studies included 677 enrolled patients who had completed baseline assessments, ranging from 20 to 148 and with an average sample size of 75. The majority of the participants were female.

Figure 1. Selection Process for Studies Included in Analysis



Outcomes Immediately Postintervention

Pain intensity. Seven studies assessed pain intensity immediately postintervention (Figure 2).[10,17-19,21,22,25] The research team performed the meta-analysis using a random effects model. The intervention groups' pain intensity was significantly lower than that of the control groups (SMD = -0.47, 95% CI: -0.93 to -0.02, $P = .04$), indicating a small to medium effect. A high level of heterogeneity existed ($I^2 = 81\%$, $\tau^2 = 0.29$, $\chi^2 = 32.41$, $df = 6$, $P < .0001$).

Figure 3 shows that no significant difference existed in pain intensity between the KT + physical therapy groups and the physical therapy groups (SMD = -0.10, 95% CI: -0.37 to 0.17, $P = .48$), with a low level of heterogeneity ($I^2 = 0\%$, $\tau^2 = 0.00$, $\chi^2 = 1.54$, $df = 2$, $P = .46$).[19-22]

No significant difference existed between the pain intensity of the KT groups and that of the minimal-intervention groups (SMD = -0.74, 95% CI: -1.57 to 0.09, $P = .08$), with a high level of heterogeneity ($I^2 = 89\%$, $\tau^2 = 0.62$, $\chi^2 = 28.43$, $df = 3$, $P < .00001$).[10,18,21,23]

Disability. Seven studies assessed disability outcomes immediately postintervention (Figure 4).[10,18,19,21-24] The research team performed a meta-analysis using a fixed effects model. No significant difference existed in disability between the intervention group and the control group (SMD = -0.08, 95% CI: -0.19 to 0.46, $P = .39$), with a low level of heterogeneity ($I^2 = 29\%$, $\chi^2 = 8.40$, $df = 6$, $P = .21$).

Figure 5 shows that, no significant difference existed in disability between the KT + physical therapy and physical therapy groups (SMD = -0.11, 95%CI: -0.39 to 0.17, $P = .44$), with a moderately low level of heterogeneity ($I^2 = 3\%$, $\tau^2 = 0.00$, $\chi^2 = 2.06$, $df = 2$, $P = .36$).[19,21,22]

No significant difference existed in disability between the KT and minimal-intervention groups (SMD = -0.14, 95% CI: -0.50 to 0.23, $P = .46$), with a moderate level of heterogeneity ($I^2 = 52\%$, $\tau^2 = 0.07$, $\chi^2 = 6.27$, $df = 3$, $P = .10$).[10,18,23,24]

Trunk flexion range of motion. Four studies assessed the trunk flexion range of motion (ROM) immediately postintervention (Figure 6).[18,22,24,26] The research team

performed a meta-analysis using a random effects model. No significant difference existed in trunk flexion ROM between the intervention and control groups (SMD = 0.47, 95% CI: 0.33 to 1.27, $P = .25$). That comparison showed a high level of heterogeneity ($I^2 = 84\%$, $\tau^2 = 0.56$, $\chi^2 = 19.06$, $df = 3$, $P = .25$).

Figure 7 shows that no significant difference existed in trunk flexion ROM between the KT and minimal-intervention groups (SMD = 0.69, 95% CI: -0.29 to 1.67, $P = .17$), with a high level of heterogeneity ($I^2 = 86\%$, $\tau^2 = 0.64$, $\chi^2 = 13.93$, $df = 2$, $P = .0009$).[18,24,26]

Only one study assessed trunk flexion ROM between a KT + physical therapy group and a physical therapy group, and no significant difference existed between the two groups.[22]

Change in status. Two studies assessed change in status immediately postintervention (Figure 8).[10,19] The research team performed a meta-analysis using a random effects model. No significant in change in status existed between the intervention and the control groups (SMD = 0.04, 95% CI: -0.88 to 1.32, $P = .93$), with moderately high heterogeneity ($I^2 = 58\%$, $\tau^2 = 0.26$, $\chi^2 = 2.38$, $df = 1$, $P = .12$)

Outcomes at Short-term Follow-up

Pain intensity. Five studies assessed pain intensity at the short-term follow-up (Figure 9).[10,18,19,23,24] The research team performed a meta-analysis using a random effects model. A significant difference in pain intensity existed between the intervention and control

Figure 2. Comparison of Pain Intensity Immediately Postintervention for the Intervention and Control Groups in the Studies Assessing the Outcome

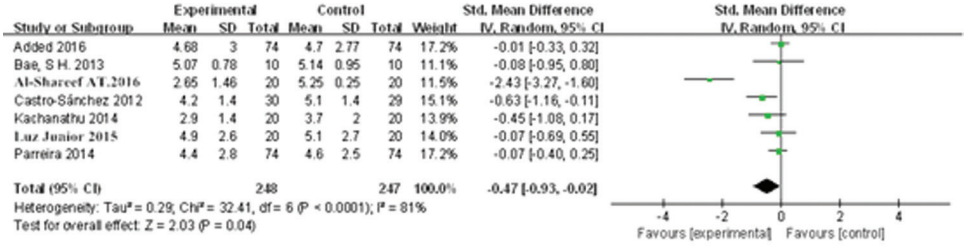


Figure 3. Comparison of Pain Intensity Between the KT + Physical Therapy and Physical Therapy Groups (3.1.1) and between the KT and Minimal-intervention Groups (3.1.2) Immediately Postintervention

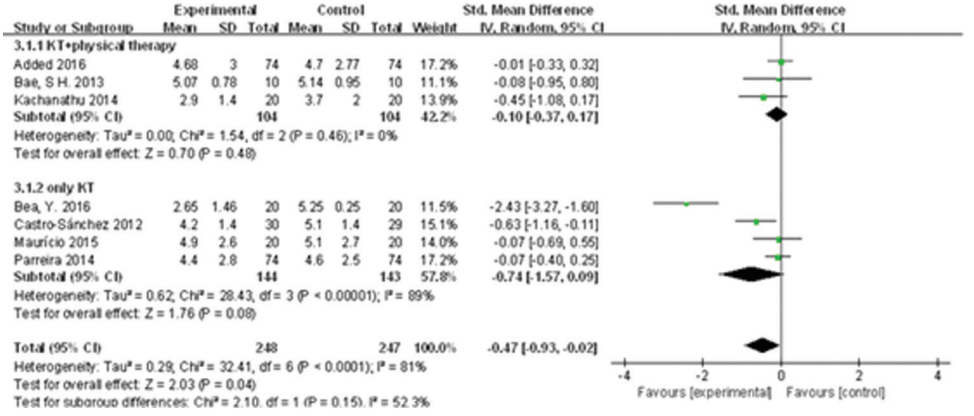


Figure 4. Comparison of Disability Immediately Postintervention for the Intervention and Control Groups in the Studies Assessing the Outcome

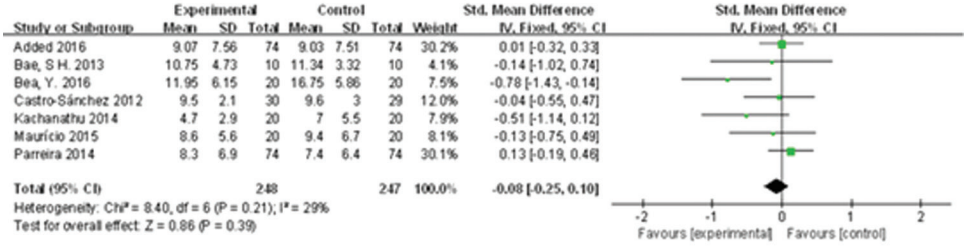


Figure 5. Comparison of Disability of KT + Physical Therapy Versus Physical Therapy (2.2.1) and between the KT and Minimal-intervention Groups (2.2.2) Immediately Postintervention

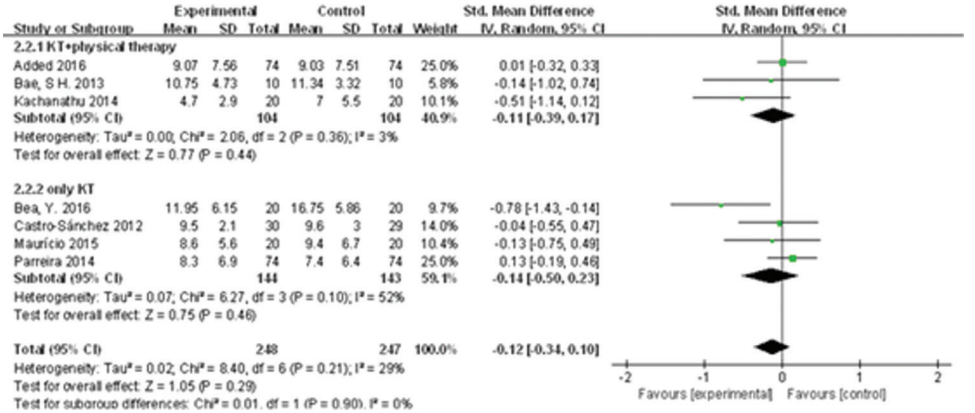


Figure 6. Comparison of Trunk Flexion ROM Outcome Immediately Postintervention for the Intervention and Control Groups in the Studies Assessing the Outcome

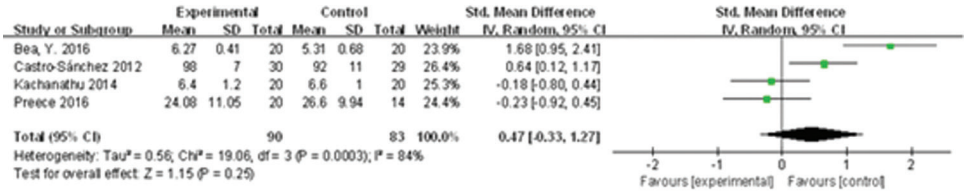


Figure 7. Comparison of Trunk flexion ROM between the KT Group and Minimal Intervention Groups (1.2.1) and the KT + Physical Therapy and Physical Therapy Groups (1.2.2) Immediately Postintervention

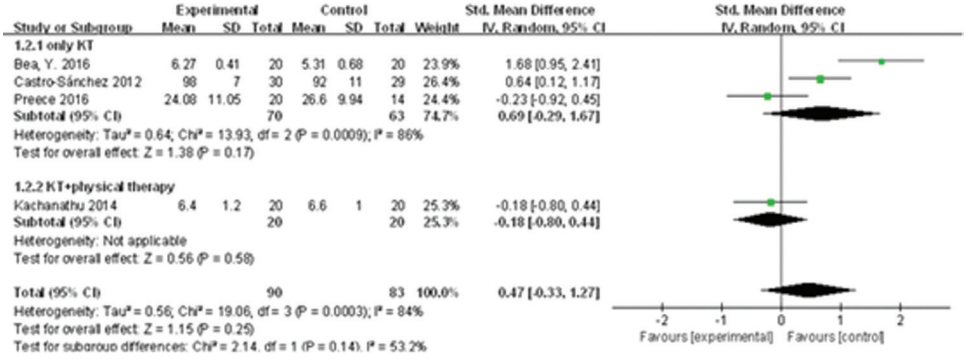


Figure 8. Comparison of Change in Status Immediately Postintervention for the Intervention and Control Groups in the Studies Assessing the Outcome

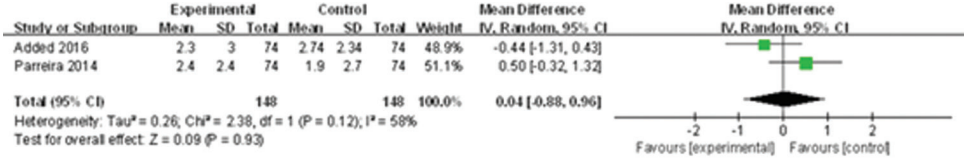


Figure 9. Comparison of Pain Intensity in the Short-term Follow-up Period for the Intervention and Control Groups in the Studies Assessing the Outcome

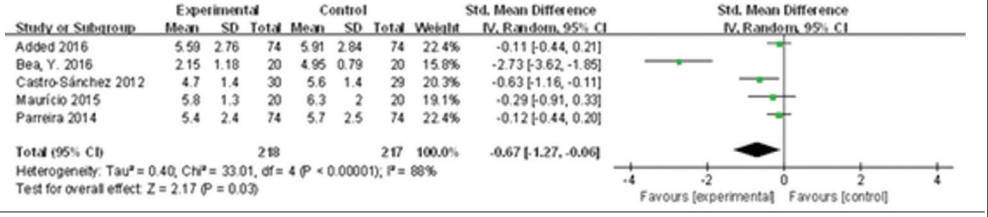
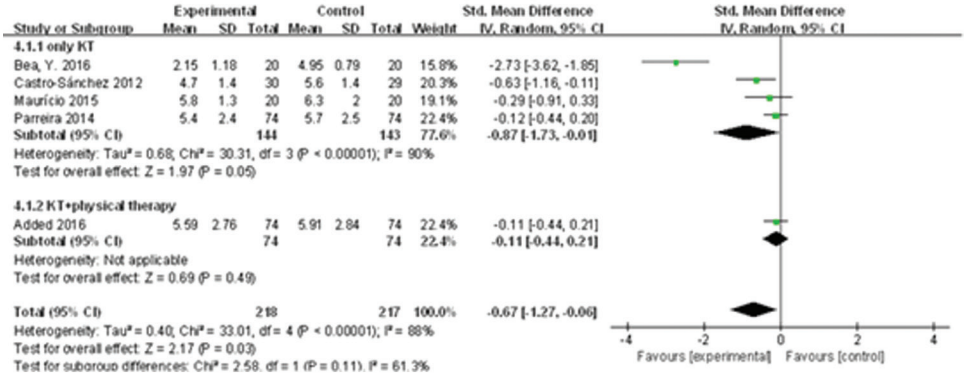


Figure 10. Comparison of Pain Intensity Between the KT and Minimal Intervention Groups (4.1.1) and the KT + Physical Therapy and Physical Therapy Groups (4.1.2) in the Short-term Follow-up Period



groups (SMD = -0.67, 95% CI: -0.44 to -0.20, P = .03), indicating a medium to large effect. A high level of heterogeneity existed (I^2 = 88%, τ^2 = 0.40, χ^2 = 33.01, df = 4, P < .00001).

Figure 10 shows that the pain intensity of the KT and minimal-intervention groups was significantly different (SMD = -0.87, 95% CI: -1.73 to -0.01, P = .05), with a high level of heterogeneity (I^2 = 90%, τ^2 = 0.68, χ^2 = 30.31, df = 3, P < .00001).[10,18,23,24]

Only one study compared pain intensity between the KT + physical therapy group and the physical therapy group at the short-term follow-up, and no significant difference existed between the two groups.[19]

Disability. Five studies assessed the disability outcomes at the short-term follow-up (Figure 11).[10,18,19,23,24] The research team performed a meta-analysis using a random effects model. No significant difference in disability existed between the intervention and control groups (SMD = -0.20, 95% CI: -0.58 to 0.18, P = .31), with a high level of heterogeneity (I^2 = 71%, τ^2 = 0.13, χ^2 = 13.75, df = 4, P = .008).

Figure 12 shows that no significant difference in disability existed between the KT and minimal-intervention groups (SMD = -0.28, 95% CI: -0.83 to 0.27, P = .32) (Figure 12), with high level of heterogeneity (I^2 = 78%, τ^2 = 0.24, χ^2 = 13.65, df = 3, P = .003).[10,18,23,24]

Only one study assessed the disability between the KT + physical therapy and the physical therapy groups at the short-term follow-up.[19] No significant difference existed between the two groups.

Trunk flexion ROM. Two studies assessed trunk flexion ROM at the short-term follow-up (Figure 13).[18,24] The research team performed a meta-analysis using a random effects model. No significant in disability existed between the intervention and control groups (SMD=1.01, 95%CI: -0.25 to 2.26, $P = .12$), with a high level of heterogeneity ($I^2 = 87\%$, $\tau^2 = 0.72$, $\chi^2 = 7.89$, $df = 1$, $P = .005$).

Only one study occurred for each subgroup. Bea et al found that KT as an adjunct to exercise therapy could increase trunk flexion ROM during a short-term follow-up, while KT only as an intervention didn't change participants' trunk flexion ROM at the short-term follow-up.[17,24]

Change in status. Two studies assessed change in status at the short-term follow-up (Figure 14).[10,19] The research team performed a meta-analysis using a random effects model. No significant difference in disability existed between the groups (MD = -0.2, 95% CI: -0.86 to 0.45, $P = .55$), with a low level of heterogeneity ($I^2 = 0\%$, $\chi^2 = 0.50$, $df = 1$, $P = .48$).

Compared with the control group, neither the KT group nor the KT + physical therapy group had a significant change in status at the short-term follow-up.

Outcomes at Intermediate-term follow-up

Pain intensity. Only two studies assessed pain intensity at the intermediate-term follow-up (Figure 15).[19,20] The research team performed a meta-analysis using a fixed effects model. No significant in pain intensity existed between the intervention and control groups (MD = -0.29, 95% CI: -0.96 to 0.38, $P = .40$), with a low level of heterogeneity ($I^2 = 0\%$, $\chi^2 = 0.96$, $df = 1$, $P = .33$).

Figure 11. Comparison of Disability in the Short-term Follow-up Period for the Intervention and Control Groups in the Studies Assessing the Outcome

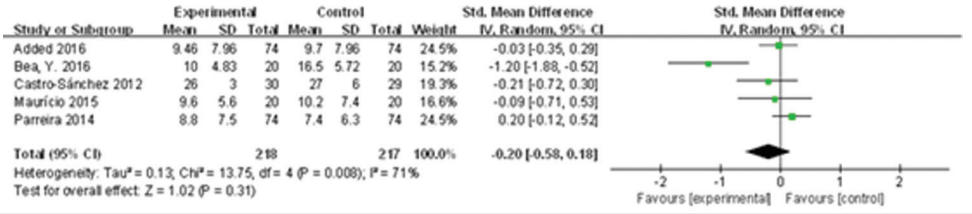


Figure 12. Comparison of Disability Between the KT and Minimal Intervention Groups (4.2.1) the KT + Physical Therapy and Physical Therapy Groups (4.2.2) in the Short-term Follow-up Period

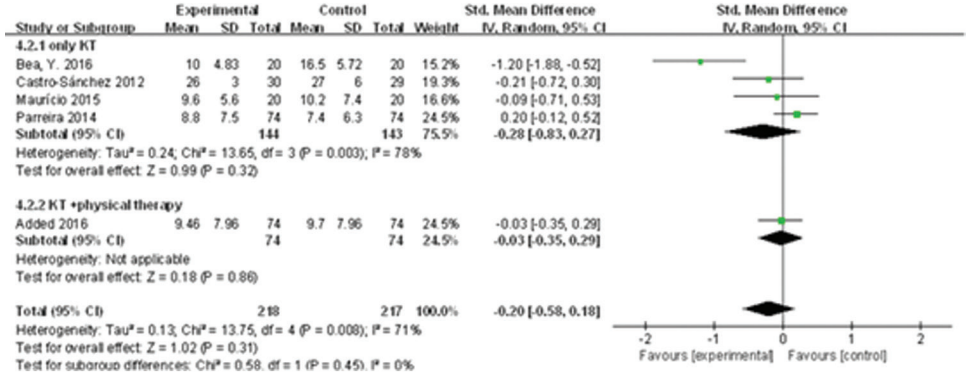


Figure 13. Comparison of Trunk Flexion ROM in the Short-term Follow-up Period for the Intervention and Control Groups in the Studies Assessing the Outcome

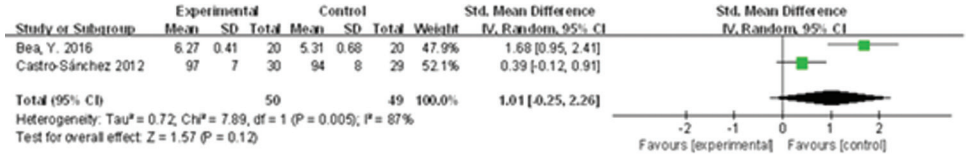


Figure 14. Comparison of Change in Status in the Short-term Follow-up Period for the Intervention and Control Groups in the Studies Assessing the Outcome

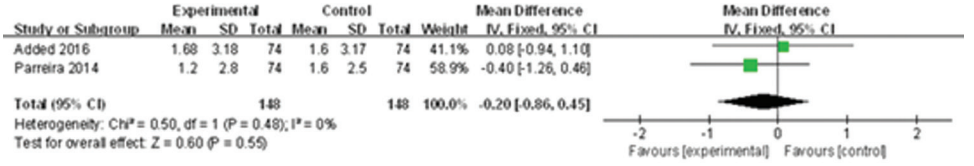


Figure 15. Comparison of Pain Intensity in the Intermediate-term Follow-up Period for the Intervention and Control Groups in the Studies Assessing the Outcome

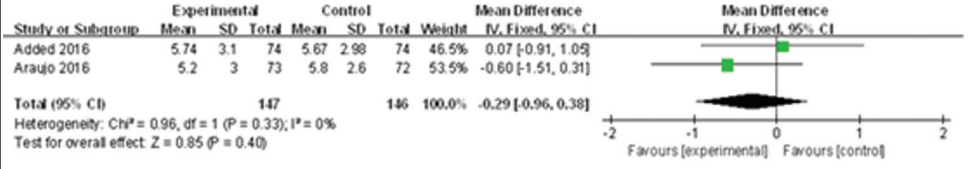


Figure 16. Comparison of Disability in the Intermediate-term Follow-up Period for the Intervention and Control Groups in the Studies Assessing the Outcome

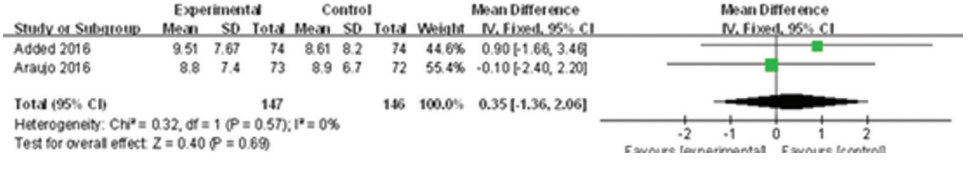
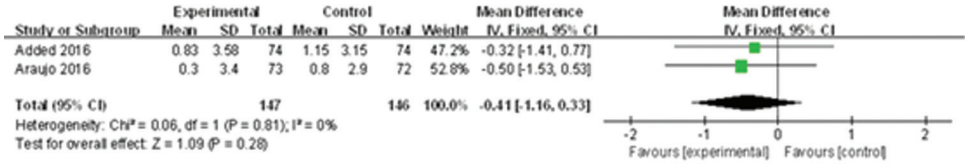


Figure 17. Comparison of Change in Status in the Intermediate-term Follow-up Period for the Intervention and Control Groups in the Studies Assessing the Outcome



Compared to the control group, neither the KT group nor the KT + physical therapy group had a significant difference in pain intensity at the intermediate-term follow-up.

Disability. Only two studies assessed disability at the intermediate-term follow-up (Figure 16).[19,20] The research team performed a meta-analysis using a fixed effects model. No significant difference in disability existed between the intervention and control groups (MD = 0.35, 95% CI: -1.36 to 2.06, $P = .69$), with a low level of heterogeneity ($I^2 = 0\%$, $\chi^2 = 0.32$, $df = 1$, $P = .57$).

Compared to the control group, neither the KT group nor the KT + physical therapy group had a significant difference in disability at the intermediate-term follow-up.

Change in status. Only two studies assessed change in status at the intermediate-term follow-up (Figure 17).[19,20] The research team performed a meta-analysis using a fixed effects model. No significant difference in the change of status existed between the intervention and control groups (MD = -0.41, 95% CI: -1.16 to 0.33, $P = .28$), with a low level of heterogeneity ($I^2 = 0\%$, $\chi^2 = 0.06$, $df = 1$, $P = .81$).

Compared to the control group, neither the KT group nor the KT + physical therapy group had a significant change in status at the intermediate-term follow-up.

Other outcomes

Castro-Sánchez et al found no advantage in using KT for CNLBP patients due to their fear of exercise and re-injury.[18] That study found that trunk muscle endurance improved significantly after one week of taping, and participants maintained the benefit at four weeks later. Kachanathu found that no significant differences in trunk extension ROM between groups receiving physical therapy with KT and without KT.[22]

DISCUSSION

Nine of the included RCTs estimated the effects of KT by comparing it with the effects of sham taping or of adding it to physical therapy interventions. The current retrospective analysis found that the significant effect of KT—reduction in pain intensity—was 0.02 to 0.93 immediately postintervention compared with control group.

Subgroup analyses revealed that neither KT alone nor KT as an adjunct to physical therapy could relieve pain intensity. The inconsistent results of KT on the pain intensity after subgrouping may be due to the fact that only two studies[19,20] had more than 50 participants. After subgrouping, the two studies belonged to different subgroups, resulting in reduced effect size.

Similarly, the current review found that pain intensity decreased significantly, from 0.06 to 1.27, at short-term follow-ups and after subgrouping. KT did relieve pain intensity when compared with the sham-taping group. However, using KT as an adjunct to physical therapy didn't decrease pain intensity when compared with physical therapy alone. This may be because only one study assessed that outcome. More research should be conducted.

Meanwhile, KT had no significant benefits in terms of disability, trunk flexion ROM, or change in status or other outcomes immediately postintervention, at the short-term follow-up, or at the intermediate-term follow-up. Several other systematic review shave assessed the effects of KT on musculoskeletal conditions or sports injuries.[9,10,13] None of those studies found favorable results for the use of KT. Al-Shareef et al believed that moderate methodological quality and small samples of RCTs included in past systematic reviews might have led to such results for the use of KT for CNLBP patients.[17]

Although the current review found no significant differences between KT as an adjunct to physical therapy and physical therapy, Added et al found that patients' pain intensity, disability, and change in status after receiving physical therapy were significantly different from the outcomes at baseline, and the difference could last from 3 to 6 months after follow-up.[19] Other studies also found significant changes for CNLBP patients after physical therapy. Thus, physical therapy as an exercise program can reduce pain intensity and improve activities of daily life, but the current review doesn't support the combination of KT and physical therapy.

This systematic review and meta-analysis has several limitations. The search strategy and inclusion criteria restricted the review to studies that assessed CNLBP, excluding case studies, cohort studies, and case-control studies. Furthermore, only nine studies met the inclusion criteria. Most of the studies reviewed had small sample sizes; only 3 had a sample of more than 100 participants.[10,19,20]

Physical therapy has various forms, but Added et al's study included only exercise and manual therapy.[19] The therapists in that study used manual therapy, including joint mobilization and myofascial release, as well as general exercise, such as aerobic activity and specific exercises, to strengthen the lumbar spine.

Bae et al subjected the L1-2 and L4-5 regions to thermal packaging, ultrasound, and transcutaneous electrical nerve stimulation as physiotherapy for 40 min each time, three times per week, for a total of 12 weeks.[21] In Kachanathu et al's study, the physical therapy included stretching exercises for the back, iliopsoas, and hamstring muscles and strengthening exercises for the abdominal muscles.[22] The amount of KT applied and the duration of each tape weren't same in the two studies.

Lim and Tay's review suggested that the effects of KT in reducing pain decreased with the application of greater tension and with the applied tape being left in place longer.[15] Follow-up times varied, and no study carried out long-term follow-up.

The current study's search duration was until 2018; future research should involve well-designed studies with longer follow-up times and sufficiently large samples.

The current research team expects to use the current analysis to carry out more large-sample, multicenter, scientifically designed RCTS in the treatment of CNLBP with an intramuscular-effect patch in the future and to conduct professional training for medical staff, so that doctors can provide patients with more effective treatment methods in clinical application.

CONCLUSIONS

KT can have immediate and short-term positive effects on reducing pain intensity, but existing evidence doesn't support KT's superiority to other interventions in improving functions for individuals with CNLBP.

AUTHORS' DISCLOSURE STATEMENT

The authors have no potential conflicts of interest to report relevant to this study.

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