

Effect of Kinesiology Taping on Pain in Individuals With Musculoskeletal Injuries: Systematic Review and Meta-Analysis

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Abstract: Kinesiology tape, an elastic tape used by sports medicine clinicians to enhance sports performance in athletes, is purported to facilitate a reduction in pain during physical activity in individuals with orthopedic injuries, but high-quality literature on this topic remains scarce. The purpose of this meta-analysis is to critically examine and review the existing literature to evaluate the effect of kinesiology tape application on pain in individuals with musculoskeletal injury. English-language publications from 2003 to 2013 were surveyed by searching SPORTDiscus, Scopus, ScienceDirect, CINAHL, Cochrane Library, PubMed, and PEDro databases using the terms *kinesio tap**, *kinesiology tap**, *kinesiotap**, and *pain*. Thirteen articles investigating the effects of kinesiology tape application on pain with at least level II evidence were selected. The combined results of this meta-analysis indicate that kinesiology tape may have limited potential to reduce pain in individuals with musculoskeletal injury; however, depending on the conditions, the reduction in pain may not be clinically meaningful. Kinesiology tape application did not reduce specific pain measures related to musculoskeletal injury above and beyond other modalities compared in the context of included articles. We suggest that kinesiology tape may be used in conjunction with or in place of more traditional therapies, and further research that employs controlled measures compared with kinesiology tape is needed to evaluate efficacy.

Keywords: kinesiology tape; pain reduction; musculoskeletal injury; range of motion

Introduction

Kinesiology taping is a commonly used intervention in the management of a number of clinical conditions, including patellofemoral pain, whiplash, and shoulder impingement syndrome. Traditional athletic tape is typically used to provide stability and protection by restricting a joint's range of motion¹; however, current evidence indicates that joint mobility restriction from taping may not benefit proprioceptive acuity in athletes with joint instability.² Conversely, kinesiology taping allows a joint to move through its full range of motion, although its mechanism of action is not well understood. Kinesiology tape deforms and stimulates large-fiber cutaneous mechanoreceptors that may inhibit nociceptive impulses in the spinal column and decrease pain via an ascending pathway. Convolutions are raised ridges of tape and skin that are thought to decompress underlying structures and allow for enhanced circulation by increasing subcutaneous space.

Despite a growing body of literature evaluating the efficacy of kinesiology taping to increase strength, improve proprioception, and decrease pain, the results of the research

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are inconclusive. In a systematic review, Mostafavifar et al³ did not find enough evidence to support the use of kinesiology taping in the treatment of musculoskeletal injury. Similarly, in another systematic review, Williams et al⁴ found that there was insufficient evidence to recommend the use of kinesiology taping to treat or prevent sports injuries. Both reviews noted that there may be potential benefits to the application of kinesiology taping, but that more research is needed to make a determination.^{3,4}

Whereas other reviews have focused on both healthy and nonhealthy populations or on multiple outcome measures, this meta-analysis seeks to critically examine and evaluate the existing literature on the specific effect of kinesiology tape application on pain in individuals with musculoskeletal injury. The hypothesis was that kinesiology tape application would be efficacious in the reduction of pain in patients with musculoskeletal injury.

Materials and Methods

Literature Search

A comprehensive and systematic search for articles from peer-reviewed journals published between 2003 and 2013 was performed. The literature search utilized SPORTDiscus, Scopus, ScienceDirect, CINAHL, Cochrane Library, PubMed, and PEDro electronic databases. The criteria consistently used were the terms *kinesio tap**, *kinesiology tap**, *kinesiotap**, and *pain*. Abstracts of all search results were analyzed in order to identify relevant articles. Full-text articles that we deemed applicable to the analysis were obtained. Additional publications were identified through manual searches of bibliographies of the related articles that we retrieved.

Inclusion

Inclusion criteria consisted of articles that evaluated the effects of kinesiology tape application on pain in individuals with musculoskeletal injury. Articles were eligible for inclusion if they were categorized as randomized controlled trials (RCTs) or cohort studies. Due to limited original research on the effects of kinesiology tape application, a specific patient population could not be extracted. As a result, studies investigating the effects of kinesiology tape application in individuals with any type of musculoskeletal injury were included. Additionally, all extracted articles included some reliable measure of pain that is also utilized in the clinical setting.

Exclusion

Articles published in languages other than English or prior to 2003 were excluded. Research investigating the effects

of kinesiology tape application on pain postsurgically or in nonmusculoskeletal conditions was also excluded. In order to evaluate the highest level of evidence, any articles categorized as below level II were omitted from this review.

Data Extraction and Quality Appraisal

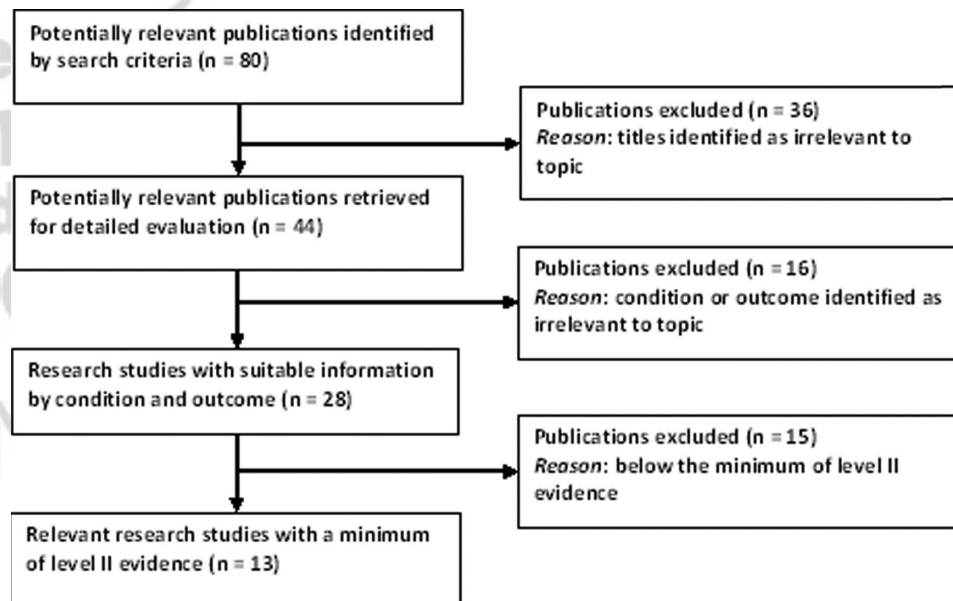
The following data were extracted from selected articles to assess the effect of kinesiology tape application on pain in musculoskeletal injuries: clinical condition, participant characteristics, intervention, comparison, outcome measures, and results. Methodological quality was critically appraised, and articles were assigned a level of evidence as described by the Centre for Evidence-Based Medicine.⁵ All eligible articles were further scrutinized for bias using a validity score (PEDro scale).⁶ Two authors independently scored the articles. In the case of discrepancies, a consensus was reached through verbal discussion. Additionally, articles that detailed means and standard deviations for both the Visual Analogue Scale (VAS) and the Pain Intensity–Numeric Rating Scale (PI-NRS) were included in a meta-analysis. A paired *t* test was used to compare standardized mean differences (SMDs) between preintervention and postintervention measures.

Results

Eighty articles were identified in the primary search. An initial analysis of titles found that 36 articles were irrelevant. An analysis of the articles' abstracts found that 16 articles did not focus on individuals with musculoskeletal injury and 8 articles did not use pain as an outcome measure. Only 13 of the remaining articles were a minimum of level II evidence. Figure 1 demonstrates the search process.

Of the articles selected, 10 were clinical trials^{7–16} and 3 were crossover designs.^{17–19} Relevant articles are outlined in Table 1 and represent the best available evidence. These articles were selected on the basis that they investigated the effect of kinesiology taping on pain in musculoskeletal injury and were a minimum of level II evidence.⁵ Table 2 provides details on study design and methodological quality. An overview of comparisons and main findings, including achievement of the minimal clinically significant difference (MCID) are demonstrated in Table 3. The MCID refers to the smallest reduction in a score that is meaningful to the patient.^{20,21} For the VAS, this difference has been found to be a 30 mm decrease.²² For the PI-NRS, this difference has been found to be a 2-point or 30% reduction.²³ There is currently no information available regarding the MCID as measured by the McGill Pain Questionnaire.

Figure 1. QUORUM-statement flow diagram illustrating the results of the literature search.



Twelve of the articles reviewed reported a statistically significant reduction in pain with the application of kinesiology taping compared with baseline measures.^{7,8,10-19} Of these articles, only 4 found a difference between the kinesiology taping group and the comparison group with regard to reduction in pain.^{7,10,11,18} Of the 10 RCTs,⁷⁻¹⁶ 8 showed a significant reduction in pain compared with baseline^{7,8,10-16} and 3 found a significant reduction in pain in relation to the comparison group.^{7,10,11} Of the highest PEDro rated clinical trials (9/11), 2 showed significant decreases in pain with kinesiology taping in relation to the comparison group^{10,11} and the third showed significant reductions in pain compared with baseline.¹⁶ Of the 5 articles that utilized a placebo control,^{9-11,16,18} 3 showed a reduction in pain compared with baseline^{10,11,16} and 2 found that kinesiology taping reduced pain significantly more than the placebo.^{10,11} One article did not find a reduction in pain⁹ and only 3 articles^{8,13,15} reached the MCID on some or all measures.^{20,22}

Results of the meta-analysis indicated that there were no overall differences between pre-intervention and post-intervention SMD in pain (Table 4). Although there were no differences found overall, results varied widely with regard to the SMD postintervention. This may be attributed to the fact that participants differed among studies with regard to pathology studied. Figure 5 demonstrates standardized mean differences between treatment and control condition and includes a forest plot that visualizes the treatment effect. This analysis visualized that there were no differences between treatment and comparison with regard to pain. However,

not all studies provided enough information to be included in the analysis.

Discussion

Because of the dearth of literature on the topic of kinesiology taping, it was more advantageous to review the effects of kinesiology taping on pain in general rather than in a specific pathology. This may have had a negative effect on the results of the meta-analysis as study populations differed. The possibility remains that kinesiology taping reduces pain in some, but not all, musculoskeletal pathologies. Such a finding would complicate theories regarding the mechanism of action that are based on ascending pathways. Studies in this review that had common clinical conditions did not necessarily have similar findings. This may be due to the fact that methods and quality varied among studies.

The results of the meta-analysis did not demonstrate differences between preintervention and postintervention SMD in pain; however, not all articles detailed the means and standard deviations for both the treatment and control groups pre- and postintervention. As a result, only 8 of the 13 studies included in this review were included in the meta-analysis. Additionally, in some articles the SMD between the treatment and control groups differed significantly, which may have made it more difficult to identify real reductions in pain.^{8,9,13}

Four of the 5 placebo-controlled studies demonstrated that both kinesiology taping and placebo kinesiology taping caused a significant reduction in pain. If kinesiology taping functions via descending inhibition or some related

Table 1. Summary of Best Evidence Available

Article	Clinical Condition	Participant Characteristics	Intervention	Comparison	Outcome Measures	Results
Akbas et al ⁸	Patellofemoral pain	Control: 15 females; mean age = 41 ± 11.3 y Kinesiology taping: 16 females; mean age = 44.9 ± 7.8 y	Individually designed kinesiology taping applications every 5 days that remained on the skin until subsequent visits with 6 weeks of at-home physical therapy exercises and progressions	No kinesiology taping with 6 weeks of at-home physical therapy exercises and progressions	Pain using VAS for 9 specified activities	Pain decreased significantly for each of the 9 positions from pretreatment measures for both kinesiology taping group and control ($P < 0.05$), but kinesiology taping group was not significantly different from control
Aytar et al ⁹	Patellofemoral pain	PKT: 10 females; mean age = 26.2 ± 3.5 y Kinesiology taping: 12 females; mean age = 22.4 ± 1.6 y	Kinesiology taping group received Y-shaped kinesiio tape on quadriceps	PKT group received same Y-shaped taping with sticking plaster	VAS for various activities 45 minutes post-application	Pain did not decrease significantly from pretreatment measures for either kinesiology taping or PKT group
Campolo et al ¹⁷	Patellofemoral pain	5 males; 15 females; mean age = 23 ± 3 y	Kinesiology taping quadriceps technique	No tape and McConnell tape	PI-NRS for squatting with 10% of body weight plus 8.5 lbs (weight box) and for stair ascent and descent	No differences among groups regarding pain during squatting ($P = 0.275$) Kinesiology tape application significantly decreased pain during stair ascent and descent vs no tape ($P = 0.034$) Kinesiology tape application did not decrease pain significantly more than McConnell tape during stair ascent and descent ($P = 0.869$)
Castro-Sanchez et al ¹⁰	Chronic nonspecific low back pain	PKT: 11 males, 19 females; mean age = 47 ± 13 y Kinesiology taping: 9 males, 21 females; mean age = 50 ± 15 y	Kinesiology taping star technique maintained in situ for 7 days	PKT I-strip maintained in situ for 7 days	VAS before intervention, 1 week postintervention, and 5 weeks postintervention	Pain was significantly lower in the kinesiology taping group vs the control group after 1 week (5.1 mm vs 4.2 mm) Pain was significantly lower in the kinesiology taping group vs the control group after 5 weeks (5.6 mm vs 4.7 mm)
Chang et al ¹⁸	Medial epicondylitis	Control: 17 males; mean age = 19.9 ± 1.5 y Kinesiology taping: 10 males; mean age = 19.5 ± 1.4 y	Kinesiology taping Y-strip over forearm	No tape, placebo tape, and healthy matched controls	VAS with pressure algometer using pressure point threshold over the wrist flexor belly and musculotendinous junction	Both kinesiology taping and placebo tape increased pain threshold and decreased VAS significantly vs no tape ($P < 0.05$) No differences between kinesiology taping and placebo with regard to pain reduction
Gonzalez-Iglesias et al ¹¹	Acute whiplash	PKT: 10 males, 10 females; mean age = 32 ± 7 y Kinesiology taping: 10 male, 11 female participants; mean age = 33 ± 6 y	Kinesiology taping Y-tape with space correction over cervical spine	PKT received perpendicular I-strips without tension over the cervical spine	PI-NRS immediate following and 24 hours postintervention application	Kinesiology taping group had a significantly greater reduction in pain than the PKT group both immediately following application (3.3 vs 4.1, $P < 0.001$) and 24 hours postapplication (3.2 vs 4.2, $P < 0.001$)

<p>Kaya et al¹²</p> <p>Shoulder impingement</p>	<p>Exercise: 25 participants; mean age = 59.5 ± 7.9 y Kinesiology taping: 30 participants; mean age = 56.2 ± 7.2 y</p>	<p>Kinesiology taping quadriceps technique and home exercise program</p>	<p>Home exercise program and modalities (transcutaneous electrical nerve stimulation, ultrasound, heat) and no tape</p>	<p>VAS at night, at rest, and with various shoulder movements before and after treatment</p>	<p>Pain decreased significantly for both kinesiology taping and control group compared to baseline at night (median = 80 mm vs 20 mm and 80 mm vs 30 mm, respectively), at rest (median = 42.5 mm vs 0 mm and 50 mm vs 0 mm, respectively), and with movement (median = 90 mm vs 30 mm and 90 mm vs 40 mm, respectively) Pain was significantly lower in the kinesiology taping group vs the control group after 1 week at night (median = 40 mm vs 70 mm, $P = 0.01$), at rest (median = 20 mm vs 50 mm, $P = 0.001$), and with movement (median = 50 mm vs 70 mm, $P = 0.001$) No differences between groups with regard to pain after 2 weeks</p>
<p>Kuru et al¹³</p> <p>Patellofemoral pain</p>	<p>Electrical stimulation: 1 male, 14 females; mean age = 40.9 ± 10.6 y Kinesiology taping: 3 male, 12 female participants; mean age = 32.9 ± 12.2 y</p>	<p>Kinesiology taping with exercise</p>	<p>Electrical stimulation with exercise and no tape</p>	<p>VAS and Kujala at baseline and posttreatment</p>	<p>Pain decreased significantly in the kinesiology taping group compared to baseline using VAS (60 mm vs 26.6 mm, $P < 0.001$) and Kujala knee pain questionnaire (85.7 vs 76.8, $P = 0.005$); Pain decreased significantly in the electrical stimulation group compared to baseline using VAS (67.3 mm vs 28 mm, $P < 0.001$) and Kujala (84.9 vs 75.3, $P = 0.016$) There were no pain differences between groups using either VAS or Kujala During both strength and endurance testing, pain decreased significantly from baseline with McConnell medial glide taping and kinesiology taping for both conditions (ES of strength: 0.269 vs 0.316; ES of endurance: 0.254 vs 0.417)</p>
<p>Osorio et al¹⁹</p> <p>Patellofemoral pain</p>	<p>7 males, 13 females; mean age = 21.2 ± 2.9 y</p>	<p>Spider upper knee kinesiology taping</p>	<p>McConnell medial glide taping and no tape</p>	<p>VAS with strength and endurance isokinetic knee extension</p>	<p>(Continued)</p>

Table 1. (Continued)

Article	Clinical Condition	Participant Characteristics	Intervention	Comparison	Outcome Measures	Results
Paolini et al ¹⁴	Chronic low back pain	Exercise: 4 males, 9 females; mean age = 62.7 ± 10.4 y Kinesiology taping: 5 males, 8 females; mean age = 62.7 ± 13.7 y Kinesiology taping + exercise: 5 males, 8 females; mean age = 62 ± 13.4 y	Kinesiology taping and kinesiology taping + exercise	Exercise	Overall low back pain using VAS at baseline and posttreatment	Pain decreased significantly with kinesiology taping (31 mm vs 71 mm, $P < 0.001$), kinesiology taping + exercise (37 mm vs 76 mm, $P < 0.001$), and exercise (35 mm vs 76 mm, $P < 0.001$) No differences found among treatment groups
Saavedra-Hernandez et al ¹⁵	Neck pain	Manipulations: 19 males, 17 females; mean age = 44 ± 10 y Kinesiology taping: 21 males, 19 females; mean age = 46 ± 9 y	Kinesiology taping Y-tape with space correction over cervical spine	Midcervical spine and cervicothoracic junction thrust manipulations and no tape	PI-NRS at baseline and 7 days posttreatment	Pain decreased in both the kinesiology taping group (2.7 vs 5.2) and the manipulation group (2.7 vs 5.0) compared to baseline; decreases were clinically significant, but not statistically significant; No differences were found between groups
Thelen et al ¹⁶	Shoulder pain	PKT: 17 males, 4 females; mean age = 19.8 ± 1.5 y Kinesiology taping: 19 males, 2 females; mean age = 21.3 ± 1.7 y	Kinesiology taping application to treat shoulder impingement applied initially and on day 3	Two neutrally placed sham kinesiology taping I-strips on the shoulder applied initially and on day 3	VAS at the endpoint	Both kinesiology taping (44.1 mm vs 20.4 mm, $P < 0.01$) and PKT (43.9 mm vs 16.8 mm, $P < 0.01$) decreased pain significantly after 6 days compared to baseline; No other differences within or among groups were found
Tsai et al ¹⁷	Plantar fasciitis	Kinesiology taping: 26 participants; mean age = 52.7 ± 28.8 y Kinesiology taping and exercise: 26 participants; mean age = 30.5 ± 13.1 y	Kinesiology taping applied to plantar fascia and gastrocnemius and physical therapy 6 days/week for 1 week	Physical therapy 6 days/week for 1 week	McGill Pain Questionnaire	Pain decreased in both the kinesiology taping group (9.3 vs 4.1, $P < 0.05$) and the control group (14.6 vs 11.9, $P < 0.05$); The decrease based on differences was significantly greater in the kinesiology taping group than the control group (-5.1 vs -2.8, $P < 0.05$)

Abbreviations: ES, effect size; PI-NRS, Pain Intensity-Numeric Rating Scale; PKT, placebo kinesiology tape; VAS, Visual Analogue Scale.

Table 2. Study Design and Quality of Selected Articles

Article	Study Design	Level of Evidence	PEDro Score
Castro-Sanchez et al ¹⁰	Randomized controlled trial	I	9/11
Gonzalez-Iglesias et al ¹¹	Randomized controlled trial	I	9/11
Thelen et al ¹⁶	Randomized controlled trial	I	9/11
Saavedra-Hernandez et al ¹⁵	Randomized clinical trial	I	8/11
Akbas et al ⁸	Randomized controlled trial	I	6/11
Aytar et al ⁹	Randomized controlled trial	I	6/11
Kuru et al ¹³	Randomized clinical trial	I	6/11
Kaya et al ¹²	Randomized clinical trial	I	5/11
Paolini et al ¹⁴	Randomized clinical trial (only phase II)	I	5/11
Tsai et al ⁷	Randomized clinical trial	I	4/11
Osorio et al ¹⁹	Randomized crossover	II	
Campolo et al ¹⁷	Crossover	II	
Chang et al ¹⁸	Crossover	II	

mechanism, it is feasible that placebo kinesiology taping functions the same way. The results from the RCTs of Castro-Sanchez et al¹⁰ and Gonzalez-Iglesias et al¹¹ suggest that under well-controlled conditions the pain reduction achieved with kinesiology taping can be greater than the pain reduction achieved with placebo kinesiology taping. However, it is important to note that the MCID was not achieved in any of these studies, indicating that neither kinesiology taping nor placebo kinesiology taping resulted in adequate pain control. Although 3 articles reached the MCID, the results indicate that the pain reduction in these studies was no different from that found in traditional treatments.^{12–14} Cumulatively, current findings indicate that the pain reduction demonstrated in the identified articles may not have been meaningful to patients or was no more beneficial than pain reduction from traditional therapies that were used for comparison.

In patients with patellofemoral pain (PFP),⁸ shoulder impingement,¹² or chronic low back pain,¹⁴ adding kinesiology taping to home therapy program resulted in comparable outcomes without any negative side effects. Reductions in pain were no different between kinesiology taping and electrical stimulation when combined with an exercise regimen¹³ in patients with PFP. Additionally, decreases in pain were no different between kinesiology taping and McConnell taping technique in the same PFP population^{17,19} and between kinesiology taping and cervical manipulations in patients with neck pain.¹⁵ These findings are similar to the preceding findings regarding the effects of kinesiology taping and placebo kinesiology taping on pain. This finding provides evidence that kinesiology taping, placebo kinesiology taping, and more traditional modalities function through the same mechanism; however, again, the MCID was not reached in most of these articles.

Table 3. Study Details for Selected Articles Arranged by Descending Order of Study Quality (Highest to Lowest)

Article	Placebo Control	Treatment Control	Tool	Pain Reduction		MCID Achieved
				Sig Over Baseline	Sig Over Comparison	
Castro-Sanchez et al	X		VAS	X	X	No
Gonzalez-Iglesias et al ¹¹	X		PI-NRS	X	X	No; 2/2 conditions
Thelen et al ¹⁶	X		VAS	X		No
Saavedra-Hernandez et al ¹⁵		X	PI-NRS	X		Yes
Akbas et al ⁸		X	VAS	X		Yes; 5/9 conditions No; 4/9 conditions
Aytar et al ⁹	X		VAS			No
Kuru et al ¹³		X	VAS	X		Yes
Kaya et al ¹²		X	VAS	X		Yes; 3/3 conditions
Paolini et al ¹⁴		X	VAS	X		Yes; 2/2 conditions
Tsai et al ⁷		X	McGill Pain Questionnaire	X	X	Unknown
Osorio et al ¹⁹		X	VAS	X		No; 2/2 conditions
Campolo et al ¹⁷		X	PI-NRS	X		Unknown
Chang et al ¹⁸	X		VAS	X		No

Abbreviations: MCID, minimal clinically significant difference; PI-NRS, Pain Intensity–Numeric Rating Scale; Sig, significant; VAS, visual analog scale.

Table 4. Results of Meta-Analysis Arranged by Study Quality

Preintervention					Postintervention					
Author	Standardized Mean Difference	Standard Error	95% CI		P value	Standardized Mean Difference	Standard Error	95% CI		P value
			Lower	Upper				Lower	Upper	
Castro-Sanchez et al ¹⁰	0.13	0.26	-0.39	0.64	0.63	0.63	0.80	0.11	1.16	0.02
Gonzalez-Iglesias et al ¹¹	0.12	0.31	-0.31	0.55	0.58	0.92	0.33	0.54	1.46	> 0.001
	0.12	0.31				1.08	0.33			
Saavedra-Hernandez et al ¹⁵	0.13	0.23	-0.32	0.58	0.60	0.00	0.23	-0.45	0.45	1.00
Akbas et al ⁸	0.18	0.36	-0.20	0.78	0.004	0.61	0.37	0.26	0.74	> 0.001
	0.45	0.36				0.85	0.38			
	0.37	0.36				0.13	0.36			
	0.63	0.37				0.50	0.36			
	0.80	0.37				0.35	0.36			
	0.54	0.37				0.73	0.37			
	0.42	0.36				0.52	0.37			
	0.29	0.36				0.25	0.36			
	0.21	0.36				0.60	0.37			
Aytar et al ⁹	0.64	0.44	-0.27	1.18	0.24	0.52	0.72	-0.25	0.72	0.34
	0.15	0.43				0.15	0.39			
	0.10	0.43				0.04	0.21			
Kuru et al ¹³	0.45	0.67	-0.27	1.18	0.22	0.10	0.31	-0.62	0.81	0.79
Paolini et al ¹⁴	0.00	0.39	-0.41	0.68	0.63	0.08	0.28	-0.43	0.66	0.68
	0.27	0.39				0.15	0.39			
Osorio et al ¹⁹	0.00	0.32	-0.44	0.44	1.00	0.16	0.40	-0.22	0.66	0.33
	0.00	0.32				0.28	0.53			

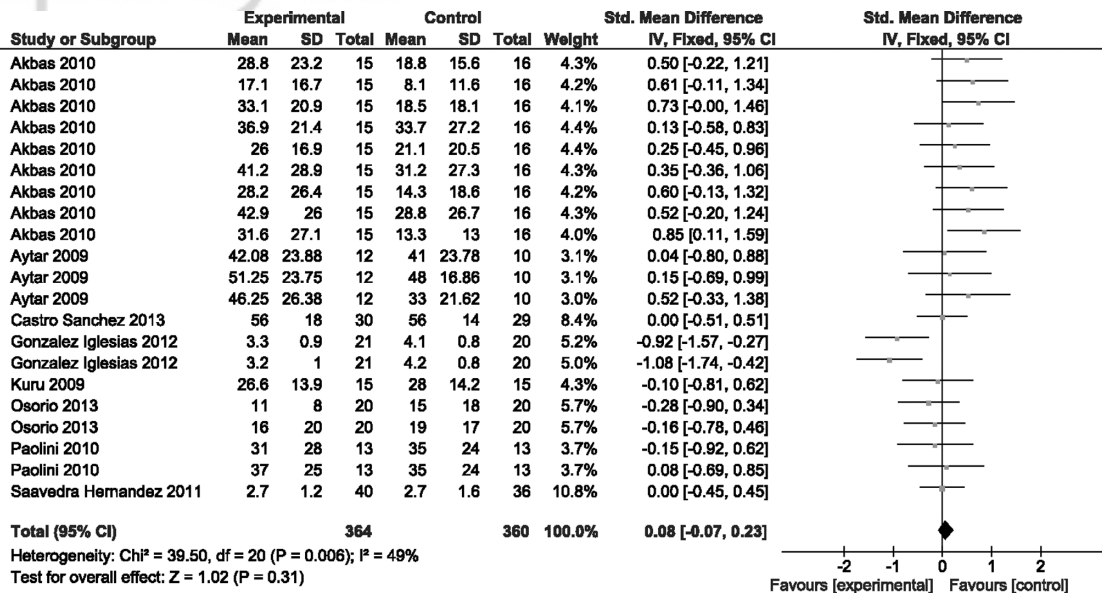
$t = -1.604, df = 20, P = 0.124.$

The effect of time on the reduction of pain using kinesiology taping should be noted. Kaya et al¹² showed an effect of time on pain with the application of kinesiology taping in patients with shoulder impingement. Pain under 3 different circumstances was significantly lower in the kinesiology taping and home exercise group than in the home exercise alone group after 1 week.¹² Similarly, Gonzalez-Iglesias et al¹¹ demonstrated that pain was significantly lower in the kinesiology taping group than the placebo kinesiology taping group immediately and at 24 hours post-application in patients with acute whiplash. In patients with chronic low back pain, Castro-Sanchez et al¹⁰ found that pain reduced significantly over placebo kinesiology taping after 1 week of kinesiology taping wear. Tsai et al⁷ found that reductions in pain were significantly greater after 6 days with kinesiology tape application and exercise than with exercise alone in patients with plantar fasciitis. Although these findings conflict with those from Akbas et al⁸, who did not show an effect of time on pain with kinesiology tape application in patients with PFP, and from Aytar et al⁹, who did not find any reductions in patients with PFP, clinicians should be aware of the possibility that kinesiology taping may cause reductions in pain more rapidly than other modalities.

The articles with the highest scores on the PEDro scale^{10,11,15,16} suggest that kinesiology taping can be used to reduce pain, although it is possible that the reduction may not be clinically significant. Both Castro-Sanchez et al¹⁰ and Gonzalez-Iglesias et al¹¹ found a significant reduction in pain over placebo. In contrast, Thelen et al¹⁶ demonstrated a reduction in pain over baseline, but not over placebo. Saavedra-Hernandez et al¹⁵ found kinesiology taping to be as effective as cervical spine manipulations in reducing pain. Findings from these high-quality studies may be more useful in determining the effect of kinesiology taping on pain.

Under well-controlled conditions, it appears that kinesiology taping is able to produce a greater statistical reduction in pain than placebo kinesiology taping. If kinesiology taping does indeed function via descending inhibition or some similar mechanism, it is possible that placebo kinesiology taping provides enough of a stimulus to have a therapeutic effect in terms of pain reduction, and that the placebo does not act as a placebo in this case. Instead, it may be that the application technique is the placebo and not the tape itself. Additionally, it should be noted that studies utilized various placebo taping techniques, ranging from kinesiology tape over the same cutaneous pattern as the therapeutic technique with

Figure 2. Standardized mean differences between treatment and control conditions with a visualization of the treatment effect.



no tension to different elastic tapes with the same technique as the therapeutic kinesiology taping. The lack of a unified application technique for placebo may have contributed to differences in findings among studies.

Conversely, kinesiology taping may function to reduce pain via the placebo effect. Sanderson et al²⁴ found that the placebo effect is a biopsychological response and suggest that its benefits should not be overlooked by clinicians. This finding is supported by Oken,²⁵ who argues that analgesic neurotransmitters are released as a result of placebo effect. Moreover, Bishop et al²⁶ found that patient expectations are significantly correlated with successful outcomes at 1 and 6 months after treatment in patients being treated for neck pain, further emphasizing the role of a psychological response during treatment of pain. In his review, Ossipov²⁷ provides evidence that pain is partially mediated via an endogenous mechanism of the brain termed the medial nociceptive system, which is thought to contribute to the emotional component of pain. This system is believed to be influenced by patient expectation, which, in turn, reduces pain via descending inhibition and the release of opioids.²⁸ These findings suggest that a placebo has a real physiological effect.

Future research on the effect of kinesiology taping on pain, especially in those patients utilizing a placebo, should focus carefully on controlling for patient expectation. To do this, researchers should specifically report how interventions are explained to patients, and the explanations should be uniform across the study population. In order to distinguish between a mechanism of pain reduction mediated by an ascending pathway and one mediated by a descending

pathway, a better placebo model for kinesiology taping application should be adopted. Additionally, subsequent research should use more subjective measures of pain, such as pain-free range of motion and disability indices, as pain is a partially psychologically-mediated outcome measure.

Conclusion

The findings from this meta-analysis showed that pain reduction achieved by kinesiology taping was no different from pain reduction achieved by more traditional modalities. Based on this result, clinicians should choose from among the therapies the one that is the most cost effective, the most time effective, the most user friendly, or the one that works best for the individual patient. Kinesiology taping offers the benefits that it is easily applied, it is both time and cost effective relative to electrical stimulation or cervical manipulations, and, in some cases, can be applied by the patient. Combined results indicate that kinesiology taping may be useful in reducing pain in individuals with musculoskeletal injury, although the reductions may not be clinically meaningful. The findings from this meta-analysis suggest that kinesiology taping may be used in conjunction with or in place of more traditional therapies, as resulting decreases in pain were no different between kinesiology taping and other modalities in the context of these articles. Additionally, the influence that the clinician's attitude has on patient outcomes cannot be overlooked. It is perhaps more important for the clinician to internalize the benefits that can be achieved through patient expectations than the benefits that can be achieved through individual modalities.²⁹ Finally, further research on the effect

of kinesiology taping on pain using an appropriate placebo control is warranted.

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Conflict of Interest Statement

Alicia M. Montalvo, MS, ATC, CSCS, and Gregory D. Myer, PhD, FACSM, CSCS*D, have no conflicts of interest to disclose. Ed Le Cara, DC, PhD, ATC, CSCS, is a presenter for Rock Tape and TRX Training.

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