

A Systematic Review of the Effectiveness of Kinesio Taping for Musculoskeletal Injury

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Abstract

Objective: Kinesio taping (KT) is used to prevent and treat musculoskeletal injuries. This systematic review examines the evidence for the effectiveness of KT in improving patient outcomes following musculoskeletal injury. **Materials and Methods:** A literature search (October 2011) was performed using PubMed, CINAHL, Scopus, SportsDiscus, and Cochrane databases. The literature search employed the keywords “kinesio tap*” or “kinesiotap*” or “athletic tap*” and “performance” or “function” or “strength” or “activity” or “pain” or “muscle” and “athlet*” or “sport*.” These searches yielded a total of 727 articles, which were reviewed thoroughly to identify suitable articles. **Results:** Six studies met our criteria and were included in this systematic review. Two of these studies examined musculoskeletal injuries in the lower extremity and reported that the use of KT did not affect outcome measures. Two studies examined musculoskeletal injuries involving the spine. Treatment with KT significantly improved pain levels and range of motion in patients with acute whiplash-associated disorders of the cervical spine both immediately and 24 hours after injury; however, the long-term results did not differ between the 2 groups. Subjects with chronic low back pain treated with KT and exercise, KT alone, or exercise alone experienced significant improvement in short-term pain, while the exercise-only group also showed significantly less long-term disability. Two studies examined musculoskeletal injuries in the shoulder. The first of these found insufficient evidence to indicate that KT decreases pain and disability in young patients with shoulder impingement/tendinitis, while the second suggested that KT may provide short-term pain relief for patients with shoulder impingement. This systematic review found insufficient evidence to support the use of KT following musculoskeletal injury, although a perceived benefit cannot be discounted. There are few high-quality studies examining the use of KT following musculoskeletal injury.

Keywords: kinesio taping; injury; tape; athlete

Introduction

Kinesio taping (KT) is a therapeutic taping technique developed by Dr. Kenzo Kase in Japan > 25 years ago.¹ This technique is used as an alternative to athletic taping to support the fascia, muscles, and joints; however, unlike athletic taping, KT allows for unrestricted range of motion (ROM) and is also theorized to reduce the time for recovery from injury by decreasing pain and inflammation.¹ This unique taping method was popularized by the press at the Seoul Olympics in 1988.¹ Since then, it has become a popular treatment modality, especially among athletes. Athletic trainers, physical therapists, and physicians have used this technique to facilitate healing after musculoskeletal injury.^{1,2}

The KT is designed to mimic the approximate thickness and weight of skin and has elasticity of up to 30% to 40% over its resting length, which gives the tape

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unique properties.^{1,3} This tape is also latex-free and features an adhesive that is 100% heat-activated acrylic.^{1,3} The 100% cotton fibers allow for evaporation and fast drying, thereby ensuring that patients can wear the tape even in the shower or pool without the need for reapplication; this allows for a wear time of 3 to 5 days and makes the treatment more economical.^{1,3}

The tape is typically applied over and around muscles to prevent over-contraction.¹ Kinesio taping is theorized to decrease pain and inflammation by improving lymphatic and blood circulation without restricting the ROM of the affected part.¹⁻³ This technique relieves pressure and irritation of the neurosensory receptors that can create pain. Furthermore, the tape microscopically lifts the skin, increasing lymphatic drainage and thus reducing inflammation in the affected areas.^{2,3}

However, as the use of KT has grown in popularity, the quality of the available evidence supporting its use after injury has been called into question. The limited information available has been mostly obtained from case series and individual patient experiences, but in recent years, more clinical trials have been undertaken to examine the effectiveness of KT. The purpose of this study was to perform a systematic review of the literature on the use of KT to

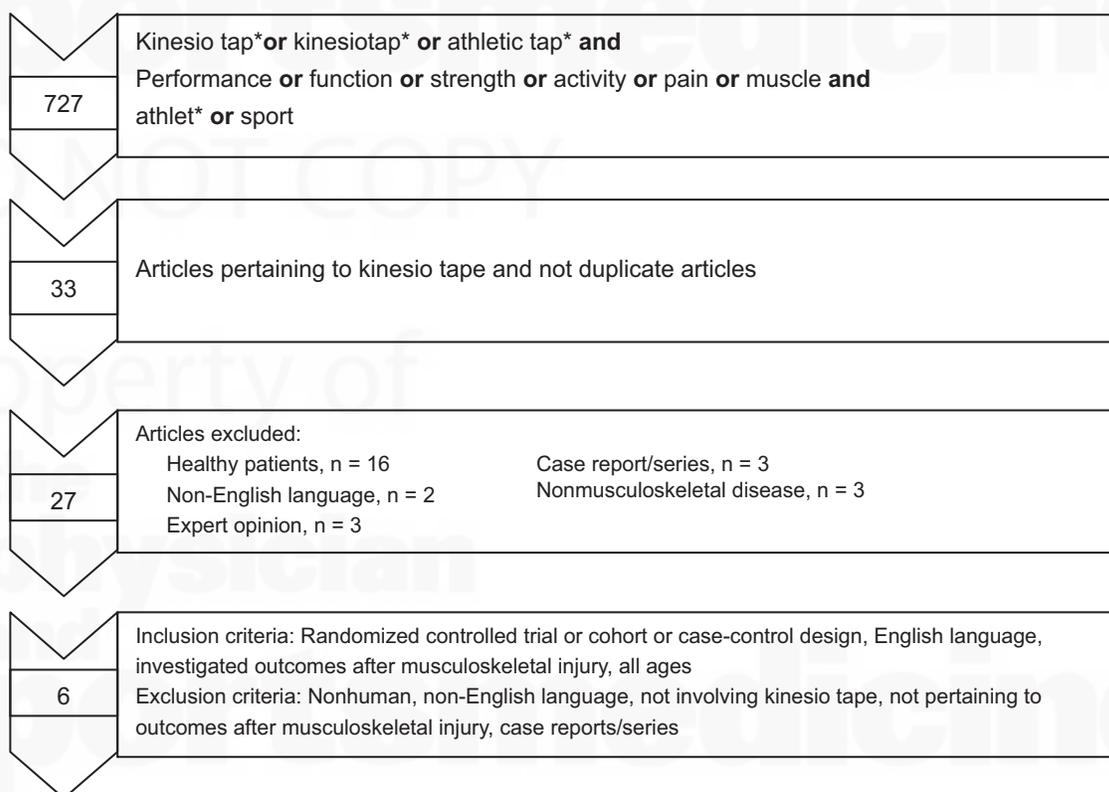
improve outcomes, including performance, pain, function, and strength, following musculoskeletal injury.

Materials and Methods

The search strategy used for this systematic review is depicted in Figure 1. A literature search, which included results inclusive through October 2011, was performed using PubMed, CINAHL, Scopus, SportsDiscus, and Cochrane databases. The literature search employed the keywords “kinesio tap*” or “kinesiotap*” or “athletic tap*” and “performance” or “function” or “strength” or “activity” or “pain” or “muscle” and “athlet*” or “sport*.” These searches yielded a total of 727 articles.

The articles were reviewed, and the inclusion and exclusion criteria established prior to the literature search was applied. The inclusion criteria were publications in English that investigated outcomes after musculoskeletal injury. The study designs included were randomized controlled trials, cohort studies, and case-control studies; case series, case reports, review articles, studies on nonhuman species, non-English language articles, and studies not involving KT were all excluded. Of the 727 original articles, 33 met the inclusion criteria. After review, 16 of 33 articles were excluded for using healthy patients (and thus not involving

Figure 1. Search strategy.



outcomes following musculoskeletal injury), 3 for being case reports/series, 3 for investigating nonmusculoskeletal disease, 3 for being opinion/review articles, and 2 for being non-English language articles. In the end, 6 articles met the inclusion criteria for analysis. Three independent reviewers reviewed and scored the 6 articles included in this systematic analysis by using a predetermined methodology described by Spindler et al⁴ and reached a consensus regarding the results and conclusions.

Results

The results of the 6 articles included in this systematic review are summarized in Tables 1 and 2.

Shoulder

Two of the identified studies examined the use of KT for shoulder pain, and both found an initial reduction in pain with a decreasing effect over time.

The first study, by Thelen et al,³ used a prospective, randomized, double-blind study design that included 42 subjects who were clinically diagnosed with rotator cuff tendinitis/impingement. The short-term effect of therapeutic KT for reducing pain and disability was evaluated in comparison with sham tape (nonstretch tape) application. The results of this study showed no significant difference in the endpoint of pain-free active shoulder ROM after KT compared with that after sham taping over the 6-day study period. Although KT did appear to provide immediate improvement in pain-free shoulder abduction ROM, the study was based on a small sample population.³ Furthermore, the study was limited to a younger population, and although the sham tape application was simpler and less precise than KT, the subjects confirmed at the end of the study that they had been unaware of what their group was to assess. Although this study suggests that KT provides some benefit immediately after application, no definite conclusion can be drawn from these results due to

Table 1. Systematic Review of KT in the Literature

Study	Objective	Study Type	Population	Cohorts	Outcomes
Thelen et al ³	To determine short-term clinical efficacy of KT	Prospective, randomized, double-blind, clinical trial using a repeated-measures design	College students enrolled at the US Military Academy; n = 42 students (mean age, 20 y)	KT vs sham tape	Primary: 100-mm VAS to assess pain intensity at endpoint of pain-free active shoulder ROM Secondary: SPADI, pain-free active ROM
Kaya et al ⁵	To determine and compare the efficacy of KT and PT in patients with shoulder impingement	Non-RCT	Patients presenting with shoulder pain indicating external impingement; n = 55 (mean age, 56.2 y)	KT vs PT	Primary: DASH Secondary: VAS pain scores
Firth et al ⁶	To investigate the effect of KT on hop distance, pain, and motoneuronal excitability in healthy patients and patients with AT	Within-subject design, nonrandomized clinical trial	26 healthy patients and 29 patients with AT recruited at the Imperial College Healthcare NHS Trust	Healthy patients vs AT	Single-leg hop test, VAS, Hoffman reflex
Paoloni et al ⁸	To determine the effects of KT on pain, disability, and lumbar muscle function in patients with chronic low back pain, both immediately and at 1-mo follow-up	Phase 1 was based on an intrasubject pre-/post-test procedure; phase 2 was based on a randomized, single-blind controlled trial	39 patients with chronic low back pain (aged 30–80 y)	KT plus exercise versus KT versus exercise	VAS, Roland Morris Disability Questionnaire, surface EMG
González-Iglesias et al ⁹	To determine the short-term effects of KT on neck pain and cervical ROM in patients with acute whiplash-associated disorders	RCT	41 patients with neck pain as a result of a motor vehicle accident within 40 d of injury meeting the WADII (mean age, 32.5 y)	KT vs sham KT (applied without tension)	Numeric pain rating scale, cervical ROM measurements
Aytar et al ⁷	To determine the acute effects of KT on pain, strength, joint position sense, and balance in patients with PFPS	Randomized, double-blind study	22 patients with PFPS (mean age, 24 y)	KT vs placebo KT	Muscle strength, joint position sense, balance, and VAS

Abbreviations: AT, Achilles tendinopathy; DASH, Disability of the Arm, Shoulder, and Hand; EMG, electromyogram; KT, kinesio tape; PFPS, patellofemoral pain syndrome; PT, physical therapy; RCT, randomized controlled trial; ROM, range of motion; SPADI, Shoulder Pain and Disability Index; VAS, visual analog scale; WADII, Whiplash-Associated Disorders.

Table 2. Results of Systematic Review of KT in the Literature

Study	Results	Conclusions
Thelen et al ³	<ol style="list-style-type: none"> 1. No significant difference between KT and sham tape groups regarding ROM, pain, or disability over 6 days ($P = 0.28$), but both groups significantly improved in all outcome measures by day 6 for a main effect for change over time ($P \leq 0.001$) 2. KT group showed immediate improvement (at day 1) in pain-free shoulder abduction ($P = 0.005$) 	May consider using for immediate improvement in pain-free ROM. Use of KT for decreasing pain or disability for young patients with suspected shoulder tendonitis/impingement is not supported.
Kaya et al ⁵	<ol style="list-style-type: none"> 1. DASH scores of the KT group were significantly lower in the control examination at the second week ($P = 0.027$) 2. VAS median pain scores (at night, rest, and movement) of the KT group were significantly lower at the first-week examination compared with the PT group ($P = 0.01, 0.001, 0.001$, respectively). However, there was no significant difference in the same parameters between the 2 groups at the second week ($P = 0.07, 0.109, 0.218$, respectively) 	KT may be an alternative or adjunctive treatment option in the treatment of shoulder impingement syndrome, especially when immediate effect is needed
Firth et al ⁶	<ol style="list-style-type: none"> 1. There was no difference in hop distance ($P = 0.55$) 2. There was no difference in VAS ($P = 0.74$) 3. The Hoffman reflexes of soleus and gastrocnemius were increased in the healthy participants after the KT was removed ($P = 0.01$ and $P = 0.03$). The Hoffman reflex remained unchanged in people with AT ($P = 0.43$ and $P = 0.16$). 	KT did not affect the level of pain or hop distance in healthy patients or patients with AT. There is a facilitation of calf muscle motoneuronal excitability after removal of KT in healthy participants
Paoloni et al ⁸	<ol style="list-style-type: none"> 1. Significant reduction in pain in all 3 groups ($P = 0.0001$) 2. The exercise-only group displayed reduced disability ($P = 0.01$) 3. A return to normal lumbar muscle function was observed in 28% of patients, but was not related to a reduction in pain. 	Exercise can improve pain and disability in patients with chronic low back pain.
González-Iglesias et al ⁹	<ol style="list-style-type: none"> 1. Significant decrease in pain immediately and at 24 hours in patients receiving KT applied with tension ($P < 0.001$ for both) 2. Significant improvements in cervical ROM in all directions in patients receiving KT applied with tension ($P < 0.001$) 	Patients with acute whiplash-associated disorders receiving an application of KT exhibited statistically significant improvements in pain levels and cervical ROM immediately and at 24-h follow-up
Aytar et al ⁷	<ol style="list-style-type: none"> 1. Significant pre-/post-differences in strength at 60 s ($P = 0.028$) and at 180 s ($P = 0.012$), and static ($P = 0.012$) and dynamic ($P = 0.046$) balance scores were indicated for the KT group 2. Significant pre-/post-differences in strength at 60 s ($P = 0.007$) and static balance scores ($P = 0.042$) for the placebo KT group 3. No significant differences were found between groups regarding the intensity of pain during ascending ($P = 0.932$) and descending ($P = 0.438$) stairs and walking ($P = 0.260$); quadriceps strength at 60 s ($P = 0.640$) and 180 s ($P = 0.311$); static ($P = 0.232$) and dynamic ($P = 0.746$) balance scores and joint position ($P = 0.151$) 	Application of KT for decreasing pain or increasing joint position sense for PFPS does not constitute an effective treatment method compared with placebo KT

Abbreviations: AT, anaerobic threshold; DASH, Disabilities of the Arm, Shoulder and Hand; KT, kinesio tape; PFPS, patellofemoral pain syndrome; PT, physical therapy; ROM, range of motion; SPADI, Shoulder Pain and Disability Index; VAS, visual analog scale.

the small sample size. It is therefore unclear whether the results, including those of the intention-to-treat analysis, are accurate. Additionally, there was no true control group to monitor the effect of the natural history of the condition over time or control for any potential Hawthorne effect.³

The second study, by Kaya et al,⁵ included 55 patients (mean age, 56.2 years) and investigated whether KT was superior to physical therapy for the treatment of shoulder impingement syndrome. In this nonrandomized clinical trial, 30 patients were treated with 3 rounds of KT at 3-day

intervals, while another 25 patients were treated with a daily program of physical therapy for 2 weeks. Both groups also performed a home exercise program twice daily over the 2 weeks of treatment. The results suggested that the KT group scored significantly lower on the Disabilities of the Arm, Shoulder and Hand outcome measure, which was assessed during an examination of the control group after the 2 weeks of physical therapy. The median visual analog scale (VAS) scores for rest, night, and movement pain were lower for the KT group than for the physical therapy

group when assessed during the examination after the first week. However, these parameters did not differ between the 2 groups when reassessed after the second week. This study concluded that KT may be a viable alternative for the treatment of shoulder impingement syndrome, especially when an immediate effect is needed.⁵ However, this study was limited to 2 cohort groups that were not clearly shown to share similar characteristics. The investigators allocated the patients to the treatment groups, meaning that the randomization process was not blinded. Furthermore, the power of the study was unclear, and there was no intention-to-treat analysis to control for subjects who did not comply with the treatment protocol. Participants in both groups performed a home exercise program to reduce the risk of equipoise, making the study comparison between KT and a particular physical therapy modality rather than physical therapy itself. Despite the differences in methodology and the study limitations, the findings support the results of the study by Thelen et al,³ suggesting that KT has an immediate effect on shoulder impingement.^{4,5}

Lower Extremity

Two studies investigated the use of KT in the lower extremities. The first study concerned the use of KT for Achilles tendinopathy and showed facilitation of calf muscle excitability in healthy subjects, while the second examined the use of KT for patellofemoral pain syndrome and demonstrated a significant effect on quadriceps strength.

Firth et al⁶ used a within-subject design to investigate the immediate effects of KT on lower extremity function (as measured by hop distance, a functionally relevant task) and pain and calf muscle excitability in healthy subjects and patients with Achilles tendinopathy. They found that KT increased calf muscle excitability in healthy subjects but had no effect on hop distance, pain, or motoneuronal excitability in patients with Achilles tendinopathy.⁶

This study had several limitations. The healthy subjects were not age- or sex-matched to the Achilles tendinopathy group. Therefore, there may be age or sex differences in the effect of the tape. The fitness levels of the 2 groups also differed. The healthy group was recruited by advertising among staff and students, while the Achilles tendinopathy group was recruited by advertising on running websites, which may have affected the results. In addition, only the immediate effects of the tape were examined. Therefore, the long-term effects of the tape remain unknown. The study did not include a placebo group; therefore, the possibility of a placebo effect cannot be excluded. The protocol was performed by investigators who

were not blinded, which could have led to bias. There was no power analysis or primary outcome stated. Therefore, we could not determine whether the study had sufficient statistical power to show differences in the outcome measures.⁶

Aytar et al⁷ used a randomized, double-blind study to evaluate the effects of KT compared with placebo KT on pain, strength, joint position sense, and balance in patients with patellofemoral pain syndrome. They found that the KT group showed significant differences in strength at 60 and 180 seconds and in static and dynamic balance scores measured by an isokinetic dynamometer. The pain level as measured by the VAS, joint position sense as measured using a dynamometer, and balance as measured by the Kinesthetic Ability Trainer 3000 (Theratek) did not differ significantly between the 2 groups.⁷

This study also had several limitations. All of the patients were female; therefore, the conclusions cannot be extended to male patients. The body mass index differed slightly between the 2 groups, which may have been a confounding factor. There was no control group to evaluate the placebo effect. This study focused on initial effects and could not determine whether additional time would have produced an effect. Furthermore, 45 minutes may be insufficient time to determine a biologic effect. This study excluded people involved in competitive sports and is therefore not generalizable to the whole population. Furthermore, 2 subjects dropped out of the placebo KT group, and no intention-to-treat analysis was performed, which may have skewed the results.

This study did not indicate how the subjects were randomized. There was no primary outcome stated or power analysis described. Therefore, we cannot determine if this study was sufficiently well powered to find a difference. Finally, the small sample size makes the results of this study difficult to accept.⁷

Spine

Two studies addressed the use of KT for the spine. The application of KT to the lumbar muscles in patients with chronic low back pain leads to short-term pain relief and improvements in lumbar muscle function. Patients with acute whiplash injury who received KT exhibited short-term improvements in pain and ROM. Paoloni et al⁸ conducted a 2-phase study consisting of a case series in phase 1 and a randomized, single-blind controlled trial in phase 2 to evaluate the effects of KT on pain, disability, and lumbar muscle function both immediately and after 1 month in patients with chronic low back pain. In phase 2, patients were randomly divided into 3 groups: KT alone, exercise alone, or KT plus

exercise. The results of phase 1 of this study showed that KT immediately reduced the VAS score significantly. In phase 2, the VAS scores decreased significantly from the baseline values in all 3 groups. The Roland Morris Disability Questionnaire scores decreased in all 3 groups, but this change was statistically significant only in the exercise-alone group. Between-group comparisons showed no significant differences. A return-to-normal lumbar muscle function was observed in 28% of patients, but this outcome did not correlate with a reduction in pain.⁸

The limitations of this study include the small sample size, absence of a primary outcome, and lack of a power analysis. The effects after > 1 month could not be determined due to the limited duration of follow-up. This study only enrolled patients who could not achieve flexion relaxation as measured by electromyography, and is therefore not generalizable to all patients with chronic lower back pain.⁸

González-Iglesias et al⁹ performed a randomized clinical trial to evaluate the short-term effects of KT on neck pain and cervical ROM in individuals with acute whiplash-associated injuries. The experimental group received kinesio tape application to the cervical spine with tension, and the placebo group received sham KT without tension. The results of this study showed that KT without tension significantly reduced pain (based on the numerical pain rating scale) both immediately and after 24 hours. The patients in the experimental group achieved significantly greater improvement in cervical ROM in all directions.⁹

The limitations of this study include the small sample size, lack of a primary outcome, absence of a power analysis, and short duration of follow-up. The main limitation of this study is its design. The 2 groups were differentiated by the amount of tension applied during KT application. The presence or absence of tension could be considered a subjective measure, which could have introduced bias.⁹

Discussion

The theory behind the use of KT is that the application of the tape improves lymphatic and blood circulation without restricting ROM and thus decreases pain, inflammation, and recovery times.^{1,2} The purpose of this systematic review was to investigate whether there are sufficient data to support the use of KT following musculoskeletal injury. Kinesio taping is potentially attractive to active patients and high-level athletes looking for a therapeutic edge to improve outcomes, including performance, pain, function, and strength, following musculoskeletal injury. This review leads to the discussion of 3 areas of clinical importance for the use of

KT following musculoskeletal injury: pain, function, and return to play.

Pain

The use of KT is theorized to decrease pain by microscopically lifting the skin and thus improving lymphatic and blood circulation as well as relieving pressure and irritation of neurosensory receptors.^{1,2} This taping technique has been reported to alleviate musculoskeletal pain not associated with injury. One such report suggests that KT might provide immediate relief of myofascial pain, with resolution over the days following its application.¹⁰ Another report suggested that the use of KT improved pain symptoms in subjects with meralgia paresthetica over a short-term period.¹¹ Our review of the use of KT following musculoskeletal injury suggests that KT might provide immediate pain relief but that the effect may not last > 24 hours.^{3,5,9} We also noted trends suggesting that KT might improve pain-related outcomes when used as an adjunctive modality to physical therapy.^{5,8} These results were similar whether KT was compared with placebo treatment or with other therapeutic modalities. The use of KT may provide immediate pain relief in the first 24 hours following application, but there is insufficient evidence to support sustained relief beyond that time, and other methods of reducing pain should therefore be considered.

Function

Kinesio tape application improves function by providing muscle support without restricting motion.^{1,2} Reports on healthy subjects suggest that KT may facilitate muscle effort.¹² One study proposed that forearm KT may enhance related or absolute force sense but did not alter maximum grip strength.¹² Another study suggested that KT improved functional performance in healthy subjects but not patients with patellofemoral pain syndrome.¹³ However, a different study using multiple types of tape, including KT, found positive changes in scapular motion and muscle performance in amateur baseball players with shoulder impingement problems.¹⁴ One study included in our review showed that the use of KT after musculoskeletal injury may immediately improve function, but it was not clear whether this effect is long lasting.⁹ Our review found no clear evidence to suggest that the use of KT alone improves strength or decreases disability, especially in comparison with exercise. We also do not know whether the effect of KT is specific to different receptors in differing anatomical areas, and this question warrants investigation. A prospective, randomized controlled study showed that the addition of KT to a conventional

exercise program did not improve the functional results of patients with patellofemoral pain syndrome beyond accelerating the improvement in hamstring flexibility.¹³ Our review supports this finding, as Paoloni et al⁸ showed that exercise improved disability but that the use of KT had no clear benefit. Although our review found that the use of KT decreases pain within the first 24 hours and possibly for up to 1 week, the supporting evidence comes from studies with small sample sizes and results that are not consistent across studies. Therefore, the usefulness of KT as an adjunctive therapy to improve function following musculoskeletal injury remains unclear.

Performance/Return to Play

Our review found no evidence that KT improves time to return to play following musculoskeletal injury. The patient or athlete may perceive that the use of KT allows him or her to return to play sooner, but there is no clear evidence to suggest that the application of the KT is correlated with improved return to play following musculoskeletal injury.

Limitations

This systematic review has several limitations. The search strategy and inclusion criteria limited the review to studies that assessed musculoskeletal injuries, excluding case series, and only 6 studies met the criteria. There are other studies that address this topic, but their results are limited by their methodologies and failures to include a control group. We recognize that these studies may contribute to the overall body of literature on this topic, but the methodology of this systematic review was to examine only evidence regarding the effect of KT on outcomes following musculoskeletal injury. Other limitations of this systematic review include the search strategy, the restriction to English language articles, and the inability to include a clear definition for musculoskeletal injury in the search. The search strategy incorporated the word “athlete” or “sport.” Therefore, our review is not generalizable to the whole population but is limited to people involved in sports or athletics. Our search did not include a clear definition of musculoskeletal injury. Although we tried to be inclusive in our broad definition of musculoskeletal injury, we realize that this definition includes many separate entities and that our results may not be generalizable to all of them. The majority of studies reviewed had small sample sizes, no primary outcome, no power analysis, and no long-term follow-up. The biologic plausibility of the purported mechanism of KT is a major limitation to its use.

The benefits of KT need to be assessed from multiple perspectives. The evidence for the biologic plausibility and clinical effect of KT is not convincing enough to recommend its use. The perceived benefit of KT is a strong factor in its use. The use of KT by elite athletes suggests that it is effective and may increase its overall use. Although there is no proven clinical benefit of KT, the risks of its use seem minimal; it is noninvasive and easily applied and removed.

Conclusion

Our systematic review found insufficient evidence for or against the use of KT to improve pain, function, performance, and time to return to play following musculoskeletal injury. The number of high-quality, consistent studies available is limited, and this topic therefore warrants further research with higher levels of evidence, larger sample sizes, powered outcomes, and longer follow-up times to show the effect—or lack thereof—of KT. There is also almost no available evidence regarding the use of KT to improve return to play. The implications of our review for current clinical practice are that KT is a safe modality, and that despite the lack of evidence to show a clinical benefit following musculoskeletal injury, the athlete may perceive a beneficial effect following KT application.

Conflict of Interest Statement

Mehran Mostafavifar, MD, Jess Wertz, DO, and James Borchers, MD, disclose no conflicts of interest.

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