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The Effects of Kinesio Taping® in Lower Limb Musculoskeletal Disorders: A Systematic Review

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ABSTRACT

Kinesio Tape® (KT) has become very popular in all stages of treatment, injury prevention, rehabilitation and performance enhancement. Despite the increasing interest and use of KT there's still a limited evidence on its effectiveness. So, the purpose was to analyse the effects of the KT in subjects with musculoskeletal disorders of the lower limb, following the rules of PRISMA reporting. The P.I.C.O. strategy was applied for literature search under the following conditions: 1) human patients with musculoskeletal disorders in the lower limb; 2) intervention including Kinesio Tape®; 3) comparisons between Kinesio Tape® and placebo, control or other tapes and; 4) containing musculoskeletal outcomes. The application of inclusion and exclusion criteria's returned seven articles from a set of one hundred and fifty-one. Additionally, the methodological quality of the selected articles was evaluated using the PEDro scale, leading to the exclusion of one of them. From the analysis of the selected studies it is suggested that Kinesio Tape® could promote positive effects on edema, pain and specific venous symptoms. On the other hand, there is no evidence on its effectiveness on health-related quality of life, strength and joint function.

Keywords: *Kinesio Tape®; musculoskeletal disorders; lower limb*

INTRODUCTION

Injuries occur very often and may be caused either during competitive or recreational sports, and non-sports activities. Actions to prevent and heal injury could include drugs, therapy/rehabilitation, nutrition and training. External supports, such as braces, elastic and non-elastic athletic tapes are often used in sports and some therapy protocols [1,2].

Among several tape brands, the most used is Kinesio Tape® (KT) [3-6]. KT is an elastic non-invasive therapeutic tape that has become very popular in all stages of treatment, injury prevention, rehabilitation and performance enhancement [2,7]. It was presented in 1979 by Kenso Kase and its international interest raised after the 1988 Seoul Summer Olympics Games [8,9]. In 1999 the first patent was published [10] and followed by many others [11-23]. In 2007, the KT Association International (KTAI) was created [9] and other trademarks have been associated, such as the Certified Kinesio Taping Practitioner®, the Kinesio® Tex (the tape itself), the Kinesio Taping® Method (procedures for tape application) and the Kinesio Tape® and/or Kinesio Taping® (a global reference of the tape or method) [7].

Over the last decade, KT has become increasingly popular and the applications have been extended to other fields, from pediatrics to geriatrics as well as some animal species [7,24,25].

The main properties attributed to KT are [2,4-6,8,9,25-31]:

- Made of elastic polymer strands, wrapped by 100% cotton fibers, latex-free, porous, hypoallergenic, waterproof and has a heat-activated acrylic glue;

- Offers many color options, satisfying the requirements of some sports and alternative medicines, such as chromotherapy;
- No medicines in the tape;
- It is applied in the back with 10% of tension to a substrate paper, which can be torn, fold back and removed in different ways;
- The texture and elasticity tries to mimic the human skin allowing more comfort, a smooth feeling and freedom of motion;
- It can be stretched in the longitudinal direction up to 120-140% of its original length and fully recover;
- Provides constant pulling (shear) force to the skin after application.
- Is thinner, lighter and more elastic than conventional tape;
- It may be used continuously, from 3 to 5 days, without losing proprieties.

The KT Method is a combination of applying tension along the tape and placing the target muscle in a stretch position [5,27,29,32]. Since the fibers of the tape are manufactured with a wave-like pattern, convolutions will appear after the recoil, creating more space between the tissues and affecting the surrounding structures and physiological systems (Figures 1a and 1b) [1,5,7,9,31].

According to the KT Method there are four main therapeutic effects:

- Re-educating muscle function: When applied proximal to distal (taking in consideration the body center) KT stimulates the muscle fibers to contract and facilitates motion. KT provides a tactile input through the skin and stimulates type 2 cutaneous mechanoreceptors, increasing the recruitment of motor units. It is also argued that KT stimulates the fascia providing higher tension to the muscle [2,7-9,24,27,32,34]. On the contrary, if KT is applied from distal to proximal the tension is relieved [2,5-7,9,24,25,27,31,35,36].
- Improving fluid exchange between tissue layers: This facilitates metabolic activity, drainage, regeneration and nutrition of injured tissues, such as edemas. The traction and convolutions at the epidermis increase the space between the skin, the muscle and, eventually, the interstitial space. This increases blood flow and lymph transportation in the subpapillary networkand skin deep vessels, eliminating tissue fluid or bleeding beneath the skin [1,2,5-7,9,25,32,35,37,38];
- Pain decreasing through neurological suppression: Convolutions reduce the nociceptive stimuli and the perception of pain. KT, rather than stimulating afferent nerves and deliver a sense of pain, stimulates the tactile neurons connecting the gelatinous substance of the posterior horn and generates a presynaptic inhibition that reduces pain (gate control theory) [2,6-9,24,25,27,31,32,35,37-39];
- Repositioning of subluxed joints: Increasing the tension of the tape (reducing the recoil) improves joint stabilization and function [7,9].

Other therapeutic effects, not defended directly by the KTAI, are:

- Improve joint proprioception [40];
- Ligament and tendon support [41];
- Postural education [42];
- Flexibility improvement [43-45];
- Correcting scar formation [29].

The therapeutic effects depend on the direction and tension applied to the KT. The following recommendations are followed [7,9,31,33,36]:

- 0 – 10 % (super light): used for the edges of the application;
- 10 – 15 % (paper off): used for fluids drainage and inhibition of the myofascia;
- 15 – 25 % (light): used for muscle inhibition if placed from distal to proximal;
- 25 – 35 % (moderate): used for muscle facilitation if placed from proximal to distal;
- 50 – 75 % (severe): used for tendon, ligament and mechanical corrections;
- 75 – 100 % (full): used for mechanical corrections and ligament techniques.

The shape of KT could also influence the therapeutic effect [7,9,31,36]. The basic recommended shapes and clinical applications are (Figure 2):

- *I*: almost every clinical issues (Figure 2a);
- *Y*: ligament, tendon and myofascial corrective techniques (Figure 2b);
- *X*: mainly in myofascial injuries (Figure 2c);
- *Fan Cut*: inflammation, edema and improvement of blood and lymph circulation (Figure 2d);
- *Web Cut*: inflammation (more intense than the *Fan Cut*), edema and improvement of blood and lymph circulation (for joints with higher ROM) (Figure 2e);
- *Donut Hole Cut*: correct space and reduce edematous or painful areas (Figure 2f);
- *Basket Cut*: Stronger than *Web Cut* and used to reduce solid or chronic edemas and some thrombophlebitis (Figure 2g);
- *Jellyfish Cut*: An evolution of the *Donut Hole* and the *Fan* cuts. Besides the earlier applications it is also used in neurological context, primarily for the relief of pain or inflammation (Figure 2h);
- *Star*: Used in trigger points, pain points and some ruptures (Figure 2i).

The procedures for a proper application, includes skin preparation, adequate shape and tension, joint position, tape handling and activation [7,9,31,33,36].

It is also argued that a cumulative effect can be accomplished combining KT with other therapies, such as cryotherapy, hydrotherapy, manual therapy, electro-

stimulation, acupuncture, ultrasound and intra-muscular stimulation [7,31].

Despite all these advantages, there are some contraindications to taking into account, before the KT applications (Table 1) [1,7,9,31].

Although there is an increasing interest and use of KT in clinical, sports and daily life activities the evidence on its effectiveness is still a limited [1,2,4,26,28,35,39,46,47]. This could be attributed to:

- Inaccurate information for study replication (e.g., tape brand and shape, origin and insertion points, applied tension, body segments positioning) [48];
- Few longitudinal studies [26,32];
- Sample characteristics: Not including healthy and non-healthy, as well as control or placebo groups [2,4,26,32,49]. Usually the sample size is also too small [26];
- Lack of blinding therapists and subjects [2,26,32]: Devising criteria to blind therapists to participants group allocation is difficult because the application is largely dependent on the desired effect;
- Scarcity of high quality studies: The majority of them are not Randomized Controlled Trials (RCT), neither double-blind or miss important information for a correct appreciation [4,5,49].

The aim of this study is to provide a systematic review about the effects of KT on musculoskeletal disorders of the lower limb. The most recent systematic reviews on KT are focused on specific sites of the human body, such as the spine [50] or the knee [46]. Following this trend, present research was focused on the lower limbs.

Material and Methods

To ensure the quality of the systematic review, the rules of PRISMA have been followed [51-53].

The literature search was conducted in electronic databases, namely, MEDLINE, Embase, Physiotherapy Evidence Database (PEDro), Springer, The Cochrane Library, SciELo, Science Direct, Google Scholar, Research Gate and B-ON. Papers were accepted in any language if a translation to English could be obtained. The search has begun in August 2015 and finished in March 2016.

The P.I.C.O. (*P*atients, *I*ntervention, *C*omparison, *O*utcomes) strategy [54-56] was applied for literature search under the following terms: 1) human **patients** with musculoskeletal disorders in the lower limb; 2) **intervention** including KT; 3) **comparisons** between KT and placebo, control or other tapes and; 4) containing musculoskeletal **outcomes**.

The following keywords were used: “Kinesio”; “Kinesio Taping”; “Kinesio Tape”; “Kinesiology Taping”; “Kinesiology Tape”; “Kinesio Tex”; “Kinesio-taping”; “Kinesio-tape”; “Kinesiotaping”; “Kinesiotape”; “Kinesio Bandage”; “Kinaesthetic Taping”; “Kinaesthetic Tape”; “Neuromuscular Taping”; “Neuromuscular Tape”; “Neuromuscular Bandage”; “Medical Taping”; “Medical Tape” (Figure 3). The keywords were identified after preliminary literature searches and by crosschecking them against previous relevant systematic reviews. Additional publications were obtained from the reference lists of articles and reviews.

Two independent reviewers applied the inclusion and exclusion criteria (Table 2) to titles and abstracts in order to identify eligible studies. Then the full versions were analyzed, including those there was any uncertainty. Further information was requested by e-mail to authors of articles presenting insufficient data. The reviewers resolved the disagreements and reached consensus through verbal discussion or arbitration.

The data that was extracted from the selected publications included: author’s name, year of publication, musculoskeletal condition, sample size and characteristics, objectives, description of the KT intervention and the control group, outcomes, assessment times, results and conclusions.

For the quality assessment, three independent reviewers scored the methodological quality of the eligible studies using the PEDro scale [57-59]. Only ratings of at least 6/10 were considered as having high methodological quality.

Results

A set of 151 records resulted from database searching. After the application of the inclusion and exclusion criteria 7 articles become eligible [33,41,60-64]. The diagram in figure 4 summarizes the selection process.

The percentage of agreement between reviewers for the individual items of the PEDro scale ranged from 36.4 to 100%. The final agreement was reached through verbal discussion or arbitration and the methodological quality of the 7 papers resulted in a mean score of 7.4 (range 5 – 9) (Table 3). One of the studies [63] was excluded because it did not reach 6/10 raising the mean score to 7.8.

In a note, the worst scored criteria was the blind therapist. In fact, it is not possible to ensure it in this type of studies. On the other hand, the best scored items were random allocation, between-group comparisons, and point estimates and variability.

Overall, the 6 selected RCT’s were published from 2010 to 2015 and conducted in Africa (Egypt) [33], Asia (Turkey) [41,62] and Europe, namely in Lithuania [64] and Spain [60,61].

Table 4 summarizes the main characteristics of the RCT’s including, objectives, sample data, cohorts, outcomes and results.

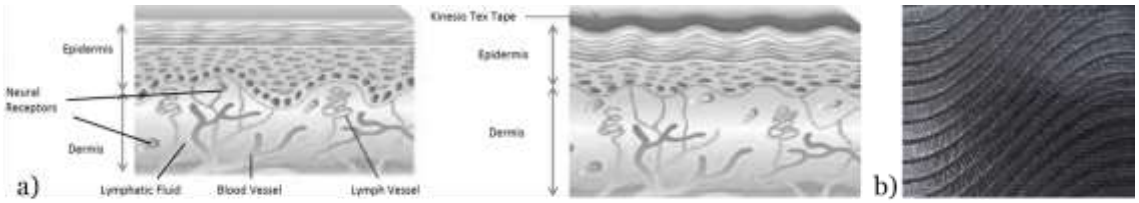

Figure 1. a) Convolutions generated after the recoil of the tape and b) Kinesio Tex® wave-like pattern. (Courtesy of Kinesio Taping® Association International).

Figure 2. Kinesio Taping® shapes.

Table 2. Inclusion and exclusion criteria

Inclusion	*Exclusion*
At least one of the keywords	Animal experimental or control group
Written in English	Another language than English
KT brand	Another brand than KT or any brand specification
Peer-review journals or papers	Any other type of publication
RCT	RCT prior to 2005 (10 years)
Experimental group with lower limb musculoskeletal disorders	Experimental group with healthy subjects
	Experimental group with lower limb non-musculoskeletal disorders
KT as the intervention group	KT as the control group
Lower limb musculoskeletal outcomes	Lower limb non-musculoskeletal outcomes
Comparison or control group	No comparison or control group
Detailed description of the KT application procedures	No detailed description of KT application procedures

1. Randomized Controlled Trial[ptyp]
2. "2005/11/15" [Pdat]: "2015/11/15"[Pdat]
3. "humans"[MeSH Terms]
4. Spanish[lang]
5. English[lang]
6. Portuguese[lang]
7. 4 OR 5 OR 6
8. 1 AND 2 AND 3 AND 7
9. "Kinesio" [All Fields]
10. "Kinesio Taping"[All Fields]
11. "Kinesio Tape"[All Fields]
12. "Kinesiology Taping"[All Fields]
13. "Kinesiology Tape"[All Fields]
14. "Kinesio Tex"[All Fields]
15. "Kinesio-taping"[All Fields]
16. "Kinesio-tape"[All Fields]
17. "Kinesiotaping"[All Fields]
18. "Kinesiotape"[All Fields]
19. "Kinesio Bandage"[All Fields]
20. "Kinaesthetic Taping"[All Fields]
21. "Kinaesthetic Tape"[All Fields]
22. "Neuromuscular Taping"[All Fields]
23. "Neuromuscular Tape"[All Fields]
24. "Neuromuscular Bandage"[All Fields]
25. "Medical Taping"[All Fields]
26. "Medical Tape"[All Fields]
27. 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19 OR 20 OR 22 OR 23 OR 24 OR 25 OR 26
28. 8 AND 27

Figure 3. Example of an online search strategy draft used in MEDLINE database

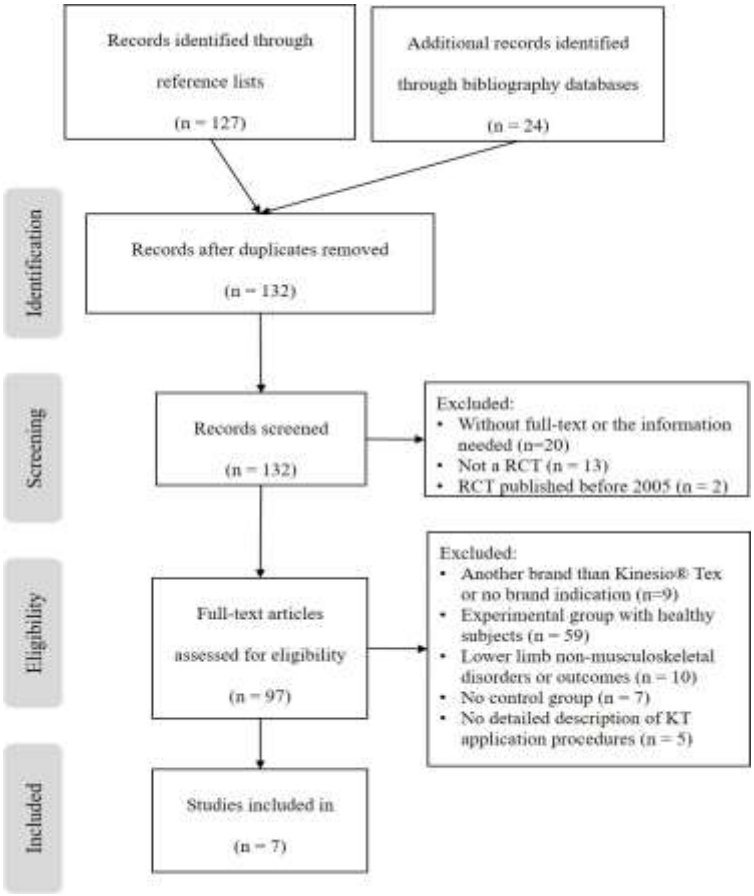

Figure 4. Flow diagram expressing the results obtained from the application of the inclusion and exclusion criteria.

Table 1. Absolut and relative contraindications for the application of KT

Absolutes	*Relatives*
Active malignancy site	Diabetes
Active cellulitis	Kidney diseases
Active skin infection	Congestive heart failure
Irritated skin	Lymphedema
Skin with tape sensitivities or bad reactions	Respiratory problems
Open wounds	Venous insufficiency
Sensitive, fragile or healing skin	Neuropathy
Sunburn	Mental illness
Deep vein thrombosis	Obesity (class I or more)
Over the umbilicus	Carotid artery disease or bruits in the carotid artery
Recent scars	Pregnancy
Recent injections site	
Blow dry	
Attached to nape of hair, though axilla or groin	
Put the patient into position	
Leave it on the skin if itching, burning or increased pain	
Touch the adhesive side too much	

Table 3. Methodological quality of eligible studies (n = 7)

Study (year)	PEDro Scale Items											PEDro Score
	1[a]	2	3	4	5	6	7	8	9	10	11	(0 – 10)
Acar et al. [41]	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	8
Aguilar-Ferrándiz et al. [60]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9
Aguilar-Ferrándiz et al. [61]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9
Aytar et al. [62]	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	7
Donec and Kriščiūnas [64]	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	6
El-Meniawy [33]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	8
Tsai et al. [63]	N	Y	Y	N	N	N	Y	N	N	Y	Y	5

1 – Eligibility; 2 – Random allocation; 3 – Concealed allocation; 4 – Baseline comparability; 5 – Blind subjects; 6 – Blind therapists; 7 – Blind assessors; 8 – Adequate follow-up; 9 – Intention-to-treat analysis; 10 – Between-group comparisons; 11 – Point estimates and variability
a – Item do not contribute to the total score
Y – Yes; N – No

DISCUSSION

The number of enrolled subjects was 441 (n_{KT}=217, $n_{control}$=224). On average the number of subjects per study was 74±40 (max=123, min=22), being for the KT group 36±20 (max=62, min=15) and for the control 37±21 (max=61, min=15). About 86% of the subjects with known gender were female (n_{KT}=180, $n_{control}$=185) with an average of 73±42 per study (max=62, min=10). Excluding the only study involving children (n=30; age of 7±1 years), the mean age of the subjects was 51±19 years.

On average the follow-up lasted 33 days, from a minimum of 45-min to assess the acute effects of KT to a maximum of 12 weeks.

Three of the studies evaluated the efficacy of the KT comparing it with a placebo KT (PKT) [46,60,62], two of them in women with chronic venous insufficiency (CVI) [46,60] and one in women with patella femoral pain syndrome (PFPS) [62].

Two of the studies evaluated the efficacy of the KT by comparing it with a standard rehabilitation program [33,64], one after total knee replacement [64], the other in children with hemiparesis [33].

In the Acar et al. [41] study the effect of KT was compared with an elastic bandage (EB) in acute lateral ankle sprain (ALAS).

The following discussion will address the main outcomes, such as edema; venous insufficiency and venous flow; pain; quality of life (QOL); strength, muscle activity and balance; joint function and gait parameters.

Edema

Edema was measured in 4 studies using measure tapes, to assess joint girth [41,60,64] or segment volume [60]. It was also used bioelectrical impedance [61] and swelling perception scales [60,61].

In the Aguilar-Ferrándiz et al. [60] study, although the subjective perception of swelling was improved, KT had no significant effect on edema reduction of the

ankle in women with CVI after 4 weeks therapy. Nevertheless, a similar study revealed that a mixed KT-compression procedure improved the perception of swelling and decreased edema in comparison to pre-treatment and a PKT group [61].

The effectiveness of KT could also be dependent on the location of edema, since it was less intense and regressed quicker after 28 days therapy in the KT group, for the thigh, knee and calf, but not for the ankle [64].

In Acar et al. [41] study the edema decreased either with the application of KT or an EB in 5 days therapy, but without differences between-groups. So it seems that KT is only as effective as EB in the treatment of acute ankle sprains [41].

Venous Insufficiency and Venous Flow

The effects of KT in venous symptoms were evaluated in women suffering from CVI in 2 studies [60,61]. Non-significant between-groups differences have been found for pruritus and temperature after 4 weeks of therapy [61] although, significant for heaviness, venous claudication, swelling and muscle cramps [60,61].

The peripheral venous insufficiency (PVI) was also evaluated using the Venous Clinical Severity Score (VCSS) [60,61]. Both studies revealed improvements in venous severity suggesting the effectiveness of KT therapy, probably related with increased muscle activity improvement and the effect of compression.

In the Aguilar-Ferrándiz et al. [61] study, the venous function was also studied using photoplethysmography (PPG), bioelectrical impedance and thermography. Except for skin temperature, between-groups differences in favour of the KT group were found in extracellular water, venous refill time and venous pump power, suggesting an overall improvement in peripheral venous insufficiency.

Pain

Pain outcome was measured in 5 studies using the Visual Analogic Scale (VAS) [60-62], the Numeric Pain Rating Scale (NPRS) [41,64] and the McGill Pain Questionnaire (MPQ) [61].

The acute effects of KT were studied by Aytar et al. [62] in subjects with PFPS. Non-significant differences were found after 45-min between the KT and a PKT group. Nevertheless, it could be argued that the applied tension (50-75% tension) was too low to promote a significant recoil and compromised the desirable effect [7,27,50].

In the case of women suffering from CVI, the efficacy of KT compared to PKT was confirmed 4 weeks post treatment, although depending on the lower body location [60,61]. A placebo effect may also have contributed to the effectiveness of KT on pain reduction [60,61]. The previous effects seem to be achieved mainly through the restriction of muscle movement and compression [60] although more fundamental research on the action mechanisms seems mandatory to understand these effects [61].

The effectiveness of KT in knee postoperative pain was confirmed by Donec and Kriščiūnas [64], particularly from the 2nd post-operative week to the end of therapy.

In the Acar et al. [41] study a significant reduction in pain score after therapy was observed for the KT and control group, but not between-groups, suggesting KT and EB have also similar effects on pain [41].

Quality of Life

Quality of life (QOL) was evaluated in 2 studies, using the Quality of Life Questionnaire in Chronic Lower Limb Venous (CIVIQ) [60] and the Short Form 36 Health Survey (SF-36) [61] after an intervention of 4 weeks. On general, both studies point in direction of no improvements in QOL, either for physical and mental health, despite significant improvements in some related parameters such as CVI severity, physical function [61] and pain [60,61]. A possible reason for that is the relatively short period of time for which QOL was evaluated.

Strength, Muscle Activity and Balance

Strength and muscle activity were assessed in 2 studies, namely through isokinetic dynamometry [62] and electromyography [60]. Static and dynamic balance were evaluated with a computerized platform [62].

Concerning the acute effects on strength, both KT and PKT groups, exhibited a significant increase after a period of 45-min, particularly at lower angular velocities [62]. Balance was also improved for the KT (static and dynamic) and PTK (static) groups [62]. Nevertheless, no significant differences have been found between-groups compromising the effectiveness of KT.

An enhancement of gastrocnemius activity was observable after a 4 weeks' therapy with KT in women suffering from CVI [60]. Stimulating gastrocnemius activity could improve muscle pump function and decrease venous stasis [60].

Joint Function and Gait Parameters

The effectiveness of KT in the ankle [33,41,60] and knee [64] joints was assessed through goniometry.

The effects of KT therapy in joint function remain uncertain. They seem to be positive in children suffering from hemiparesis, where ankle excursion was improved after 12 weeks' therapy, along with some gait parameters such as step length, cadence and velocity [33]. In women suffering from CVI non-significant results were registered in ankle ROM despite a decrease in pain and an improvement in some venous parameters [60]. In subjects suffering from acute lateral ankle sprain the ankle function was improved after 5 days' therapy, either with KT and EB, but without significant differences between-groups [41].

Concerning the knee joint, KT seems to be effective in improving knee extension 16 days after total knee replacement, but not flexion [64].

Finally, it is argued that KT stimulates the cutaneous mechanoreceptors increasing joint awareness [9,32,40]. Aytar et al. [62] tried to confirm the ability to predict knee joint position comparing KT with PKT but non-significant differences were found after a period of 45-min. In this case, however, it would be better do compare KT with a control group without any tape because an effect of PKT on mechanoreceptors should not be excluded.

Conclusions

It may be concluded that KT could be is as effective as EB in edema reduction, pain decrease and ankle function. Both materials are adhesive, elastic and capable of promoting compression and convolutions which could explain the similar effects on many parameters.

A 4 week KT therapy in women suffering from CVI produces improvements in several venous symptoms (e.g., claudication, swelling, heaviness, muscle cramps, refill time, VRT, VPP, ECW). The underlying mechanism is probably related with the convolutions generated by KT improving fluid exchange and circulation. The effects on male populations are unknown. Studying the long-term effects of KT should also be pursued, namely their effects on the QOL scores, which have not been significant for the above mentioned period.

KT seems also to be effective in pain reduction of women suffering from CVI, and approximately 2 weeks after knee post-operative therapy.

The effectiveness of KT in joint function requires further research. The effects seem to be positive only in children suffering from hemiparesis where ankle excursion was improved after 12 weeks' therapy. They also seem to depend on the type of joint (ankle or knee), joint action (e.g., flexion/extension), population and health condition. The effects of the hip joint are still to be studied. Further research seems mandatory to confirm the effects of KT in improving joint sense.

Finally, it should be kept in mind that the long term effects of KT therapy remain unknown, particularly, after 12 weeks' therapy. Moreover, KT is used in a long-term basis, in many sports either during training sessions or competition. Thus, performance and health-related outcomes seem also an interesting issue for future research.

The main critical aspects of KT application seem to be the selection of the correct shape and tension along with its integration on the whole rehabilitation/therapy protocol.

Conflict of interest

The authors have no conflicts of interest to disclose.

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Table 4. Summary of selected papers

Study	Objectives	Subjects	Cohorts	Outcomes Measures	Results
Acar et al. [41]	Effects of KT on ankle excursion and gait in children with hemiparesis.	n_{total} =30 (7±1 years) n_{KT}=15 $n_{control}$=15	KT: Therapeutic exercises (gait training applying neurodevelopmental technique, proprioceptive training, facilitation of righting, equilibrium, protective reactions and stretching exercises) + KT (two I strips for function correction. One strip from the plantar surface of the foot, through the middle three toes, to the anterior aspect of tibia, with paper-off tension. One strip placed on the plantar surface of the mid-foot between the calcaneus and metatarsal heads with paper-off tension. Then applied diagonally over the anterior ankle with increased tension on the lateral section to promote eversion. Then, it continued up to the lower leg parallel to the first strip with paper-off tension at the end). Every day therapeutic exercises, 12 weeks. Four days of KT with 24h rest for 12 weeks. Control: The same therapeutic exercises. Every day, 12 weeks.	ROM: Goniometer Gait: step length, cadence, velocity, foot prints	Significant improvement (p<.05) in ankle excursion, step length, cadence and velocity for KT and control. Significant differences (p<.05) between-groups after treatment in the favor of KT
Aguilar-Ferrándiz et al. [60]	Acute effects of KT on pain, strength, joint position sense, and balance in patients with PFPS.	n_{total}=22 (24±3 years; female) n_{KT}=12 (22±2 years) $n_{control}$=10 (26±4 years)	KT: Two Y strips with paper-off tension applied over MV and LV from origin to insertion, with the tails applied around the patella with 50-75% tension just below the tibia tuberosity. Two I strips over the patella with 50-75% tension. Before and 45 min after application. Control (PKT): Sticking plaster was applied without stretch. Before and 45 min after application.	Pain: VAS Quadriceps strength and joint position: Isokinetic dynamometer Static and dynamic balance: KAT	Join position sense and pain did not differ for KT and control Strength increase at 60º/s for KT (p=.028) and control (p=.007) Strength increase at 180º/s for KT (p=0.012) Improved static balance for KT (p=.012) and control (p=.042) Improved dynamic balance for KT

					(p=.046) No differences between groups for any of the measures.
Aguilar-Ferrándiz et al. [61]	Efficacy of KT on venous symptoms, QOL, severity, pain, edema, ROAM, and peripheral myoelectrical activity of postmenopausal women with mild CVI.	n_{total}=123 (66±8 years; 100% female) n_{KT}=62 (66±14 years) $n_{control}$=61 (63±14 years)	KT: One Y strip on the MG and 1 on the LG placed origin to insertion with 15-50% tension and the ends tension-free for muscle activation. One I strip with 50% tension to stimulate dorsal flexion. Three times per week during 4 weeks. Control (PKT): The Y and I strips were applied disregarding the correct position and without tension. Three times a week during 4 weeks.	Edema: Leg volume with a measure tape Pain: VAS CVI severity: VCSS Peripheral muscle pump: EMG ROM: Goniometer QOL: CIVIQ	KT: improvements in pain distribution (p<.001), venous claudication (p<.015), swelling (p<.002), heaviness perception (p<.001), muscle cramps (p<.001), and CVI severity (p=.001). Pain decrease within-group for control (p<.001) and KT group (p<.007). Greater in the KT than in the control (p=.003) KT had more electrical activation than control group for the external and internal calf muscle of both limbs. Between-group differences in venous symptoms, such as in pain location (p=.001), venous claudication (p=.042), swelling (p=.020), heaviness (p=.030) and muscle cramps (p=.001). Non-significant changes in QOL, lower limb volumes and ankle ROM (p>.05)

Aytar et al. [62]	Effect of a mixed KT treatment in women with CVI.	n_{total}=104 (female) n_{KT}=50 (64±13 years) $n_{control}$=54 (66±13 years)	KT: One Y strip on the MG and 1 on the LG placed origin to insertion with 15-50% tension and the ends tension-free, for muscle activation. Two I strips with 50% tension at malleolar level to exert peripheral venous compression. Three times per week during 4 weeks. Control (PKT): The Y and I strips were applied disregarding the correct position and without tension. Three times a week during 4 weeks.	PVF: PPG (peripheral reflux), bioelectrical impedance (peripheral edema) and thermography (lower limb skin temperature). Severity and overall health: VCSS (venous severity), SF-36 (QOL), MPQ including VAS (pain) Venous symptoms: 4-point scale	Lower scores in KT compared to control in heaviness (p=.002), venous claudication (p=.004), swelling (p=.001), muscle cramps (p=.008), VRT (right: p=.023 and left: p=.001), VPP (right: p=.004 and left: p=.001), ECW (right: p=.004 and left: p=.001), VCSS (p=.001), physical function (p=.003), body pain (p=.043) and MPQ in sensory (p =.001), evaluative (p=.032), PRI (p=.009) and VAS (p=.001). Non-significant differences (p<.05) between-group in pruritus, cell mass, fat mass, ICW, temperature, physical role, general health, vitality, social function, emotional role, mental health and MPQ in affective and PPI.
Donec and Kriščiūnas [64]	Effectiveness of KT in postoperative pain, edema and knee function recovery after total knee replacement in early postoperative rehabilitation period.	n_{total}=89 n_{KT}=40 (67±11 years; 88% female) $n_{control}$=49 (68±8 years; 84% female)	KT: Rehabilitation program (mobilization, physical and occupational therapy, compression, massage, TENS, laser and paraffin therapy, psychologist and social worker) + KT (2 or 3 *Fan Cut* applied with paper-off tension on the frontal, medial and lateral aspects of the knee for lymphatic correction. An Y strip with paper-off tension applied proximal to distal in the RF for facilitation and a I strip with 50% of tension in the medial knee ligaments, for stimulation of mechanoreceptors, proprioception and pain reduction). Every day for 28 days. Control: Same rehabilitation program and therapy duration.	Edema: Leg circumference with a measure tape Pain: NPRS ROM: Goniometer	Edema was less intense and regressed quicker (p<.05) in KT, except in the ankle region. Pain decrease in both groups (p< .05), but higher in KT (p<.05) from the 2nd post-operative week to the end of therapy. Better knee extension (p<.05) in KT than in control at the 16th, 24th and 28th postoperative day. No differences found in knee flexion improvement (p>.05).
El-Meniawy [33]	KT *vs* EB in treatment of	n_{total}=73	KT: 2 days rest + 5 days standard therapy [ankle elevation + ice application + NSAID + KT (lymphatic	Swelling and edema: Ankle girth	Ankle Girth: within-group decrease in days 1, 3, 7 and 28 (p<.0001), but non-

	ALAS in short a term period.	n_{KT}=38 (37±11 years; 56% female) $n_{control}$= 35 (34±10 years; 53% female)	correction with 2 *Fan Cut* with light paper-off tension on the medial and lateral aspects of the ankle)]. Control (EB): Same standard therapy, with EB replacing KT.	with a measure tape ROM: Karlsson scoring scale and a goniometer Pain: NPRS	significant between groups (p=.544). Karlsson score: within-group improvement in days 1, 3, 7 and 28 (p<.0001), but non-significant between groups (p=.144). NPRS: within-group decrease in days 1, 3, 7 and 28 (p<.0001), but non-significant between groups (p=.943). Non-significant differences in analgesic use (p=.001).

Legend: **ALAS**: Acute Lateral Ankle Sprain; **CIVIQ**: Quality of Life Questionnaire in Chronic Lower Limb Venous; **CVI**: Chronic Venous Insufficiency; **EB**: Elastic Bandage; **ECW**: Extracellular Water; **EMG**: Electromyogram; **ICW**: Intercellular Water; **KAT**: Kinesthetic Ability Trainer; **KT**: Kinesio Tape; **MPQ**: McGill Medlnack Pain; **NPRS**: Numeric Pain Rating Scale; **NSAID**: Non-Steroidal Anti-inflammatory Drug; **PFPS**: Patella Femoral Pain Syndrome; **PKT**: Placebo Kinesio Taping; **PPG**: Photoplethysmography; **PPI:** Present Pain Intensity; **PRI:** Pain Rating Index; **PVF**: Peripheral Venous Flow; **QOL**: Quality of Life; **ROM**: Range of motion; **SF-36**: Short Form 36 Health Survey; **TENS**: Transcutaneous Electrical Nerve Stimulation; **VAS**: Visual Analog Scale; **VCSS**: Venous Clinical Severity Score; **VPP**: Venous Pump Power; **VRT**: Venous Refill Time.