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Angiología

Review

Effect of kinesiotape on venous insufficiency. Systematic review

Efecto del kinesiotape *en la insuficiencia venosa. Revisión sistemática*

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Abstract

Kinesiotape (KT), by provoking skin folds, could have effects on the circulatory system. This would allow its application in pathologies with edema, such as chronic venous insufficiency (CVI). However, there is insufficient scientific evidence.

For this reason, the aim of this study was to determine the effect of different applications of KT on venous circulation in patients with CVI.

To this end, a literature search was carried out following the guidelines of the PRISMA statement in February and March 2023 in 10 databases.

The search yielded 113 studies, of which 4 articles were included for subsequent analysis. The main variable studied was pain, which was present in all studies. The main effect observed on KT in CVI was a decrease in pain.

Currently, the overall evidence of the effect of KT in CVI is contradictory and the isolated use of KT in CVI cannot be prescribed. Published clinical trials on this topic are limited.

Keywords:
Athletic tape. Venous insufficiency. Edema. Cardiovascular system.

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Resumen

El *kinesiotape* (KT), al provocar pliegues cutáneos, podría tener efectos sobre el sistema circulatorio. Esto permitiría aplicarlo en patologías que cursen con edema, como la insuficiencia venosa crónica (IVC). Sin embargo, no existe evidencia científica suficiente.

Por este motivo, el objetivo de este estudio consistió en determinar el efecto de las distintas aplicaciones de KT sobre la circulación venosa en pacientes con IVC.

Para ello se realizó una búsqueda bibliográfica siguiendo las directrices de la declaración PRISMA en los meses de febrero y marzo de 2023 en 10 bases de datos.

La búsqueda arrojó 113 estudios, de los cuales se incluyeron 4 artículos para su posterior análisis. La principal variable estudiada fue el dolor, presente en todos los estudios. El principal efecto observado sobre el KT en la IVC fue la disminución del dolor.

Actualmente, la evidencia general del efecto del KT en la IVC es contradictoria y no se puede prescribir su utilización aislada en la IVC. Los ensayos clínicos publicados sobre esta temática son limitados.

Palabras clave:
Cinta atlética.
Insuficiencia venosa.
Edema. Sistema cardiovascular.

INTRODUCTION

The Japanese Kenzo Kase developed kinesiotape (KT) in the 1970s of the last century, which consists of an elastic bandage with high capacity for longitudinal elongation. Unlike other taping techniques (such as functional taping), the main objective of KT is not to restrict movement but was designed to provide mechanical support to soft tissues and joints. Since then, its popularity has grown significantly to its application in different medical specialties (1-3).

The main applications of KT focus on the musculoskeletal system (4,5), but it has expanded to other fields, such as neurology or rheumatology. However, despite its increasing use in clinical practice, there is not enough scientific evidence to support its use in all areas (6). For this reason, the effects attributed to it in its origins continue to be investigated, so currently its theoretical uses and effects have not been clarified (2,6,7).

Regarding its characteristics, KT tapes are designed to mimic the thickness, density, and flexibility of the skin. KT is made of 100% cotton, which promotes evaporation and quick drying. At the same time, this quality allows prolonged use, usually 3 to 5 days. The hypoallergenic acrylic adhesive is applied in the form of elongated S-shapes, also called fingerprint lines, and is activated by heating the tape by friction ("activation of taping"). It should be noted that the tape is adhered to a protective paper with an initial tension of 25% (4,5). Figure 1 shows the characteristics of the KT tape.

The different therapeutic objectives posed with KT require specific application parameters, such as tension, placement direction, and tape cutting (4,5).

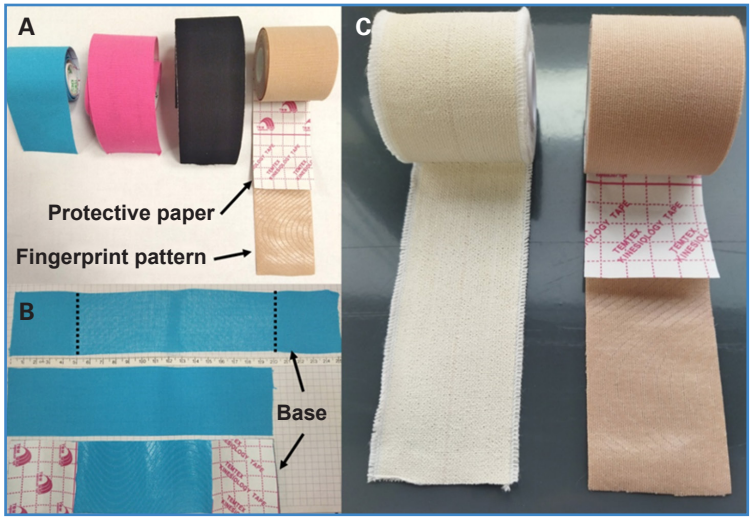

Figure 1. *Characteristics of KT. A. Different samples of KT, showing the protective paper and fingerprint pattern of the acrylic. B. Sample of KT bandage extensibility: bases have a length of 5 cm and the active zone of 10 cm. The upper strip has been applied with maximum stretch. C. Comparison of conventional elastic bandage (left) with KT bandage (right).*

The colors of the tape, despite being striking, do not provide different therapeutic effects because the mechanical properties are the same (6).

When KT tape is applied to the skin, it generates skin folds that, when lifting the skin, provoke effects on the circulatory and lymphatic systems. This effect causes a decrease in intratissular pressure and an increase in microcirculation. This is because elevation increases the subcutaneous cellular space. Finally, a pressure difference occurs between the taped area and the adjacent tissues, facilitating lymphatic and venous circulation. Additionally, there is a decompression of nociceptors, which relieves pain (5,8).

KT applications directed at the circulatory and lymphatic systems could be used in different conditions that present with edema, such as lymphedema, heart failure, or chronic venous insufficiency (9).

On the other hand, chronic venous insufficiency (CVI) includes a wide variety of venous conditions, in which there is mainly an alteration of venous return due to valve incompetence or abnormalities of vein walls. Its main signs and symptoms in the lower limbs include pain, heaviness, swelling, or itching, associated with a general discomfort sensation. The population most affected by this condition are women and the elderly. It is also associated with pregnancy, obesity, immobility, and comorbidities (10-14).

It is estimated that 90% of the literature on KT studies the osteoarticular field, with the spine being the most analyzed region. Additionally, 5% corresponds to the neurorehabilitation area and another 5% to the lymphatic system (15). Currently, there is not enough evidence about KT in the venous system nor a consensus regarding the basic aspects of the technique, despite the high influence on blood circulation of the physiological effects described. On the other hand, most studies conducted have low methodological quality and do not analyze long-term benefits. Furthermore, the effects of KT have been associated with the placebo effect (16-18).

Therefore, the aim of this work was to carry out an updated systematic review that analyzes the different types of existing KT applications to understand its effectiveness on venous circulation.

MATERIALS AND METHODS

Search strategy

This systematic review was carried out following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. A literature search was conducted in February and March 2023, in the following databases: PubMed, Scopus, Cinahl, SPORTDiscuss, Medline, Cochrane Library, Physiotherapy Evidence Database (PEDro), Dialnet, ENFISPO, and Web of Science (WOS).

Descriptors were selected in the searches according to the topics addressed in this review. The equations used in each database are shown in table I.

Selection criteria

The inclusion criteria for selecting articles in the different databases were:

- That the study type was a randomized controlled trial (RCT).
- That these studies aimed primarily to analyze the effects of KT on CVI.

Conversely, the following were excluded:

- Those studies written in a language other than English or Spanish.
- Other types of studies or publications, such as doctoral theses.

To eliminate duplicate articles, a bibliographic manager (Mendeley Reference Manager v2.97.0 for Windows) was used for subsequent selection.

Analysis of methodological quality and assessment of risk of bias

To analyze the methodological quality of the selected RCTs, the PEDro scale (19) was used. The Van Tulder criteria were also used to specify the levels of scientific evidence possessed by the RCTs selected for the systematic review (20). Finally, the risk of bias in the selected research was evaluated according to the indications of the Cochrane Collaboration (21).

Table I. Search equations

Database	Search equation
PubMed	("kinesiotap*" OR "taping" OR "kinesio tap*" OR "kinesio-tap*" OR "kinesio-tap*" OR "kinaesthetic tap*" OR "Athletic Tape"[Mesh] OR "kinesiology tap*" OR "elastic therapeutic tape" OR "neuromuscular taping") AND ("Venous Insufficiency"[Mesh] OR "Varicose Ulcer"[Mesh] OR "venous insufficiency" OR "varicose veins" OR "venous insufficiency syndrome" OR "chronic venous insufficiency" OR chronic venous disorder* OR "Chronic venous disease" OR "CVI" OR ((insuffic* OR insufic* OR CVI OR isch* OR incompet* OR chronic) AND (vein* OR veno*)) OR "CVD")
Scopus	("kinesiotap*" OR "taping" OR "kinesio tap*" OR "kinesio-tap*" OR "kinesio-tap*" OR "kinaesthetic tap*" OR "Athletic Tape" OR "kinesiology tap*" OR "elastic therapeutic tape" OR "neuromuscular taping") AND (("Venous Insufficiency" OR "Varicose Ulcer" OR "venous insufficiency" OR "varicose veins" OR "venous insufficiency síndrome" OR "chronic venous insufficiency" OR ("chronic AND venous AND disorder*) OR "Chronic venous disease" OR "CVI" OR ((insuffic* OR insufic* OR cvi OR isch* OR incompet* OR chronic) AND (vein* OR veno*)) OR "CVD"))
Cochrane Library	("kinesiotap*" OR "taping" OR "kinesio tap*" OR "kinesio-tap*" OR "kinesio-tap*" OR "kinaesthetic tap*" OR "Athletic Tape" OR "kinesiology tap*" OR "elastic therapeutic tape" OR "neuromuscular taping") AND ("Venous Insufficiency" OR "Varicose Ulcer" OR "venous insufficiency" OR "varicose veins" OR "venous insufficiency syndrome" OR "chronic venous insufficiency" OR chronic venous disorder* OR "Chronic venous disease" OR "CVI" OR ((insuffic* OR insufic* OR CVI OR isch* OR incompet* OR chronic) AND (vein* OR veno*)) OR "CVD")
SPORTDiscuss + Medline + Cinahl	((("Venous Insufficiency" OR "Varicose Ulcer" OR "venous insufficiency" OR "varicose veins" OR "venous insufficiency syndrome" OR "chronic venous insufficiency" OR chronic venous disorder* OR "Chronic venous disease" OR "CVI" OR "CVD") AND ((insuffic* OR insufic* OR CVI OR isch* OR incompet* OR chronic) AND (vein* OR veno*))) AND ("kinesiotap*" OR "taping" OR "kinesio tap*" OR "kinesio-tap*" OR "kinesio-tap*" OR "kinaesthetic tap*" OR "Athletic Tape" OR "kinesiology tap*" OR "elastic therapeutic tape" OR "neuromuscular taping"))
PEDro	Search 1: Kinesio tap* AND "Venous Insufficiency" Search 2: orthoses, taping, splinting (therapy); oedema (problem); cardiothoracics (subdiscipline)
Web of Science	("kinesiotap*" OR "taping" OR "kinesio tap*" OR "kinesio-tap*" OR "kinesio-tap*" OR "kinaesthetic tap*" OR "Athletic Tape" OR "kinesiology tap*" OR "elastic therapeutic tape" OR "neuromuscular taping") AND ("Venous Insufficiency" OR "Varicose Ulcer" OR "venous insufficiency" OR "varicose veins" OR "venous insufficiency síndrome" OR "chronic venous insufficiency" OR "chronic venous disorder*" OR "Chronic venous disease" OR "CVI" OR ((insuffic* OR insufic* OR CVI OR isch* OR incompet* OR chronic) AND (vein* OR veno*)) OR "CVD")
Dialnet	Search 1: Kinesio AND "insuficiencia venosa" Search 2: insuficiencia venosa (contains the words), neuromuscular bandaging (titles)
ENFISPO	(kinesiotape OR "vendaje neuromuscular" OR KT) AND ("insuficiencia venosa" OR "insuficiencia

For the analysis of the aforementioned risk of bias and its representation, the robvis visualization tool (22) was used (available at: https://www.riskofbias.info/welcome/robvis-visualization-tool).

RESULTS

The search yielded a total of 185 articles: 8 in PubMed, 42 in Scopus, 16 in WOS, 11 in Cinahl, SPORTDiscuss, and Medline, 83 in Cochrane Library, 20 in PEDro, 2 in Dialnet, and 3 in ENFISPO. Out of these 185 articles, and after several screenings, eventually 4 publications were included to address the objective of this review (23-26).

The study selection process is depicted in the flow diagram according to the PRISMA 2020 guidelines (27) (Fig. 2).

Regarding the characteristics of the sample (Table II), subjects with mild or moderate chronic

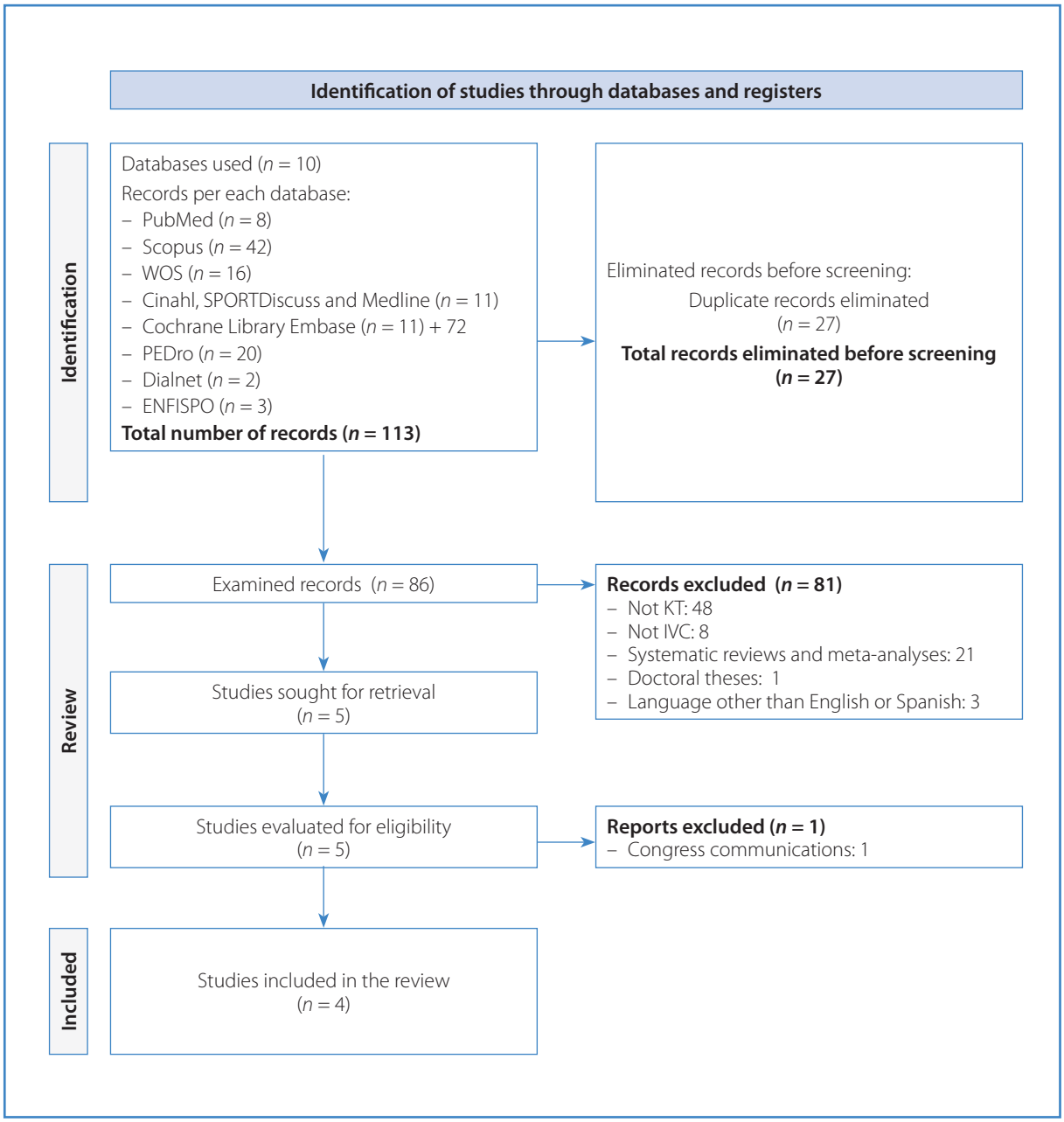

Figure 2. *Flow diagram according to PRISMA.*

venous insufficiency (CVI) were evaluated in all studies (23-26). In 3 of them (23,24,26), the subjects were exclusively postmenopausal women, while in the remaining one, both sexes were included (25). Figure 3 shows different applications of KT used in the studies (described in Table II).

The sample size was greater than 100 in 3 articles (23,24,26). The total number of subjects evaluated was 435.

The variables measured among all articles are summarized in table III.

As reflected in Table III, in the articles where the efficacy of KT treatment was compared to placebo treatment, the experimental group showed improvements in almost all measured variables compared to the control group. On the other hand, in these studies, pain also decreased in the control groups (23,24,26).

Table II. Main characteristics of the studies

Study and year Country	Sample	Intervention characteristics	Band application parameters
Aguilar et al., 2013 (24) Spain	*n* = 123 postmenopausal women in early staEG of CVI EG: 62 CG: 61	3 times per week 4 weeks EG: KT on gastrocnemius and anterior tibialis CG: Placebo KT	*Gastrocnemius:* EG: 2 Y-shaped strips. Anchored without tension at insertion and with knee in neutral position. Applied with knee extension and maximum ankle dorsiflexion following muscle path (tension 15-50 %) CG: 2 Y strips without tension and not following anatomical path *Anterior tibialis:* EG: Applied with 50 % tension with foot in dorsiflexion on medial third of anterior tibialis and 3rd metatarsal on dorsum of foot (forming a bridge with strip) CG: Short strip without tension not following anatomical structure
Aguilar et al., 2014 (a) (23) Spain	*n* = 130 postmenopausal women with mild CVI EG: 65 CG: 65	3 times per week 4 weeks EG: KT on gastrocnemius, anterior tibialis, and ankle CG: Placebo KT	*Gastrocnemius:* EG: 2 Y-shaped strips. Anchored without tension at insertion and with knee in neutral position. Applied with knee extension and maximum ankle dorsiflexion following muscle path (tension 15-50 %) CG: 2 Y strips without tension and not following anatomical path *Anterior tibialis:* EG: Applied with 50 % tension with foot in dorsiflexion on medial third of anterior tibialis and 3rd metatarsal on dorsum of foot (forming a bridge with strip) CG: Short strip without tension not following anatomical structure *Ankle:* EG: 2 strips at 50 % tension. First part of inner zone of middle third of foot continues towards inner malleolus, surrounds outer malleolus, and spirals up to distal third of tibia. Other strip follows same path but in reverse, starting from outer zone of middle third of foot CG: Short and semicircular strip without tension, simulating ankle compression
Aguilar et al., 2014 (b) (26) Spain	*n* = 120 postmenopausal women with mild to moderate CVI EG: 60 CG: 60	3 times per week 4 weeks EG: KT on gastrocnemius, anterior tibialis, and ankle CG: Placebo KT	*Gastrocnemius:* EG: 2 Y-shaped strips. Anchored without tension at insertion and with knee in neutral position. Applied with knee extension and maximum ankle dorsiflexion following muscle path (tension 15-50 %) CG: 2 Y strips without tension and not following anatomical path *Anterior tibialis:* EG: Applied with 50 % tension with foot in dorsiflexion on medial third of anterior tibialis and 3rd metatarsal on dorsum of foot (forming a bridge with strip) CG: Short strip without tension not following anatomical structure *Ankle:* EG: 2 strips at 50 % tension. First part of inner zone of middle third of foot follows path towards inner malleolus, surrounds outer malleolus, and spirals up to distal third of tibia. Other strip follows same path but in reverse, starting from outer zone of middle third of foot CG: Short and semicircular strip without tension, simulating ankle compression

(Continued on next page)

Table II (cont.). Main characteristics of the studies

Study and year Country	Sample	Intervention characteristics	Band application parameters
Naci et al., 2020 (25) Turkey	*n* = 62 patients in early stage of CVI EG: 29 CG: 29	4 weeks EG: KT once a week CG: Medium compression stockings (class II)	*EG:* Closed basket technique: for large and lymph-rich areas. Strip folded in half and cut into 3 equal parts. Unfolded and folded again to middle each half, then cut into 4 equal parts. Anchored without tension above distal part of symptoms. Placed proximally with 5-25 % tension (15 %) Closed fan technique: for legs and areas with mild symptoms. Folded in half and cut into 5 equal parts. Anchored without tension above distal part of symptoms. Placed proximally with 5-25 % tension (15 %) *CG:* Class II compression stockings (23-32 mmHg) They are worn throughout the day except for sleeping and bathing. They could reach up to the knee or thigh depending on the patient's symptoms.

CG: control group; CVI: chronic venous insufficiency; EG: experimental group; KT: kinesiotape; ROM: range of motion.

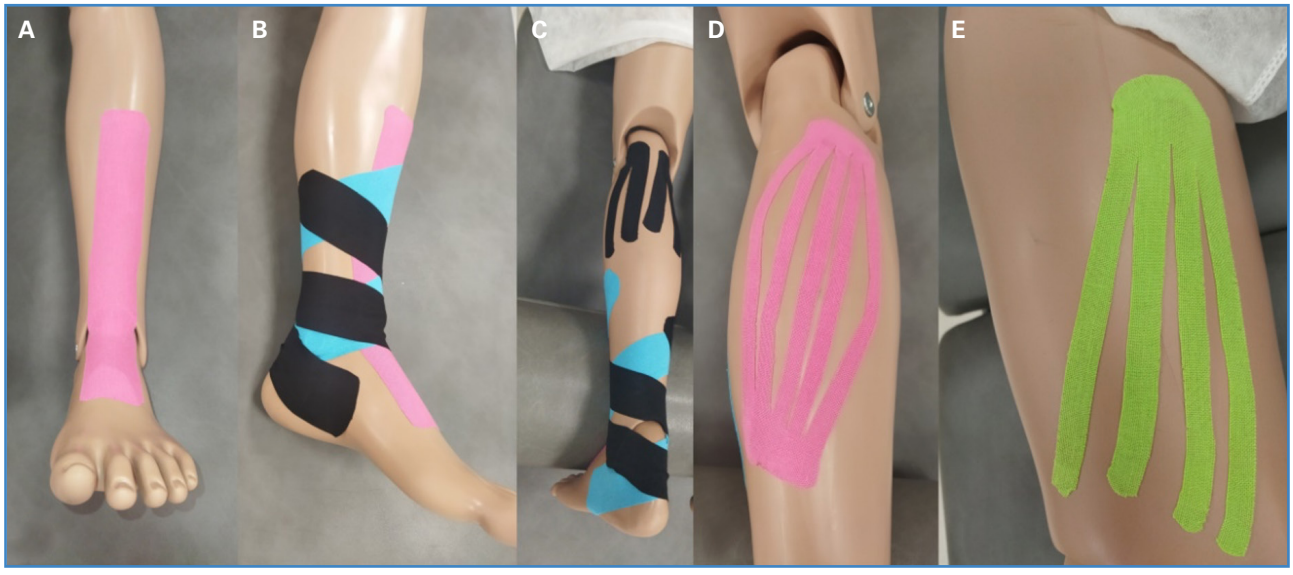

Figure 3. *Applications of KT related to the included studies. A. Application for functional ankle correction (I-cut over tibialis anterior). B. Strips for venous compression from internal and external malleolar regions. C. Y application for gastrocnemius stimulation. D. Closed fan cut. E. Open fan cut.*

However, in the only study that compares the effectiveness of KT with an alternative treatment, in this case compression stockings, greater improvements were found for the latter group (25).

The mean obtained from the evaluation of methodological quality according to the PEDro scale was 8.5. Table IV shows the results broken down for the fulfillment of the PEDro scale criteria for each article.

To assess the risk of bias, the recommendations of the Cochrane Collaboration (21) were followed. The biases least present in the studies included in this review were selection bias and detection bias, as there was a low risk in items D1, D2, and D4 for all ar-

Table III. Variables measured and results obtained from the studies

Study and year Country	Measurements	Results
Aguilar et al., 2013 (24) Spain	At baseline and at 4 weeks Venous symptoms, severity of CVI, pain, lower limb volume, electromyographic data of the calves, ankle ROM, quality of life	In the EG: improved pain distribution, decreased venous claudication, decreased swelling, decreased heaviness, decreased muscle cramps, decreased itching, decreased severity of CVD In both the EG and the CG: decreased pain Unchanged: quality of life, leg volume, ankle ROM
Aguilar et al., 2014 (a) (23) Spain	At baseline and 48 hours post-treatment Angle ROM, gait, pain, lower limb circumference, quality of life	In EG: ↓ quality of life, ↓ ankle dorsiflexion ROM during gait, improvement in gait cadence, ↑ stride length, ↑ step length, improvement in stance phase during gait, ↓ foot and ankle circumference In EG and CG: ↓ pain
Aguilar et al., 2014 (b) (26) Spain	At baseline and 4 weeks post-treatment Venous symptoms, pain, photoplethysmographic measurements, bioelectrical impedance, temperature, severity and general health status	In EG: ↓ heaviness, ↓ claudication, ↓ swelling, ↓ muscle cramps, ↓ venous filling time, improvement in venous pump function, ↓ extracellular fluid, ↓ severity, improvement in physical function In EG and GC: ↓ pain
Naci et al., 2020 (25) Turkey	Before and 4 weeks post-treatment Pain, lower limb circumference, functional capacity, quality of life	In CG: ↓ pain, ↓ ankle circumference, ↓ calf circumference, ↓ knee circumference, ↓ thigh circumference. No differences between EG and CG: functional capacity, quality of life In EG and CG: improvement in 6MWT and physical components

CG: control group; CVI: chronic venous insufficiency; EG: experimental group; rom: range of motion; sf-36: short form-36; vas: visual analog scale; 6mwt: 6-minute walk test; ↓: significant decrease.

Table IV. Evaluation of the methodological quality based on the PEDro scale

	Criteria of the PEDro scale											
Article	1	2	3	4	5	6	7	8	9	10	11	Total
Aguilar et al., 2013 (24)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	9
Aguilar et al., 2014 (a) (23)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	9
Aguilar et al., 2014 (b) (26)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	9
Naci et al., 2020 (25)	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	7

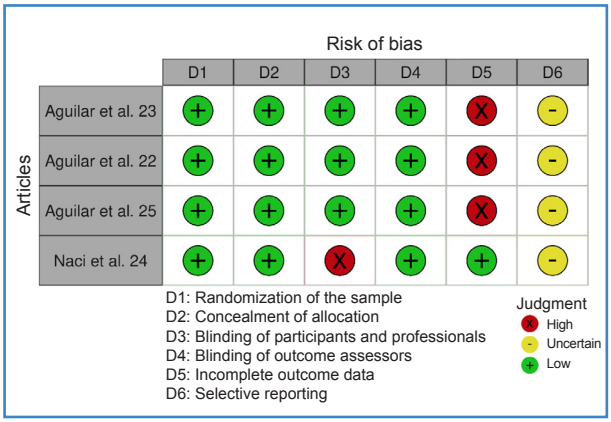

Figure 4. *Risk of bias assessment for each study.*

ticles (23-26). Conversely, the most prevalent bias is attrition bias, and a high risk of loss during follow-up was found in 75% of the articles (23,24,26).

The risk of bias assessment is graphically represented individually for each study in figure 4 (22).

DISCUSSION

The main results obtained in the present literature review indicate that the application of KT could provide significant improvements in some of the symptoms

present in CVI vs placebo treatment with KT. However, it cannot be concluded that it is more efficient vs other types of approaches used in CVI.

The most studied variable was pain (23,24,26). In the 3 studies (23,24,26) comparing the application of KT with placebo treatment, a significant reduction in pain was obtained in both the experimental and control groups. This suggests the possibility of a placebo effect, produced by the sensation of trust and security resulting from receiving treatment, reinforced by the visual input of the tape (28). Although other approaches for CVI show similar—or worse—results vs placebo (29), which highlights the difficulty of evaluating such effect.

In the study conducted by Ceniza et al. (30), the effectiveness of KT was compared to conventional adhesive tape. Statistically significant and clinically relevant changes in pain were obtained in both groups. These materials have different compositions and properties, as conventional tape is non-elastic, so it cannot increase the subcutaneous space (does not generate convolutions), which could indicate that KT has a placebo effect in the management of pain.

On the other hand, in most studies (24,26), an improvement in venous symptoms and CVI severity was observed. However, this progress is associated with increased electromyographic activity of the gastrocnemius muscles (24). The effect of KT on modulating the electrical activity of the muscles has been observed previously (31,32).

In the leg, the muscular action of the gastrocnemius muscles has a significant impact on venous emptying and return (33). In the study by Ovelar et al. (33), using ultrasound imaging, it was observed that contraction of the lower limb muscles causes a decrease in venous diameter and an increase in flow both in ankle plantar and dorsiflexion.

In a recent study by Li et al. (34), a higher femoral vein flow velocity was evidenced with various types of active ankle exercises, as opposed to performing the same movements passively.

Therefore, KT could act through its effect on muscles, as it was observed to increase calf muscle endurance (35). In this research, it is proposed that KT could stimulate the autonomic nervous system, leading to an improvement in intramuscular blood flow and lymphatic drainage (35).

Regarding the variable of quality of life, contradictory results were obtained, as some studies did not describe changes (24,25), while others showed a significant improvement (23). The disparity in results may result from the use of different questionnaires. According to Geraldo et al. (36), the CIVIQ-20 and CIVIQ-14 variants are highly reliable for assessing the quality of life of patients with CVI, regardless of its severity. However, other questionnaires, such as the Venous Insufficiency Epidemiological and Economic Study - Quality of Life (VEINESQoL) or the Aberdeen Varicose Vein Questionnaire (AVVQ), were found to have questionable validity or inadequate consistency for accurately analyzing the degree of quality of life in these patients. Likewise, the SF-36 questionnaire (37) could be too generic an instrument for measuring health-related quality of life in such a specific population.

Regarding the lack of effect of KT on range of motion (ROM) in patients with CVI (24), it can be associated with the demographic variables of the sample (postmenopausal women) and the natural progression of CVI (increased connective tissue disorganization) (10,14).

Previous studies analyzing the effect of KT on knee edema, pain, and ROM observed an effect on all variables, except ROM (38). The effect on this variable still needs to be elucidated.

Likewise, contradictory results were obtained regarding edema reduction. In one article (24), no significant changes were observed, while in two others volumetric reduction was noted (23,26). The results are explained by the KT application performed, as significant results were observed with a compressive application of KT (23,26). However, KT is not usually applied with a compressive component (4,5). Typically, a fan cut (Fig. 3E) or thin strips are applied aiming for cranial drainage (39).

The analysis of KT efficacy compared to other techniques is limited by the small number of articles included. Only 1 of the 4 articles included in the review (25) contained a comparative treatment, in this case compression stockings, which are considered the gold standard for CVI treatment. However, this article has the lowest score on the PEDro scale and, therefore, less validity and reliability in its results.

In addition to compression stockings, which form the basis of all conservative treatments for CVI, adjunct therapies such as manual lymphatic drainage and phlebotonics are proposed, among others (40). Therefore, future studies should be conducted to compare these treatments.

Compression measures are a strategy in CVI. Compression primarily aims to neutralize the force of gravity, which opposes venous and lymphatic return from the lower limbs, favoring reflux and worsening the clinical picture of CVI. This pressure can be transmitted by an external (bandages or stockings) or internal agent (muscle contraction, which causes an increase in tension caused by bandages) (41). In contrast, KT does not describe a direct compressive effect. Regarding CVI, the applications described aim to increase venous and lymphatic flow, as well as provoke muscle activation (4-6). Therefore, it would be necessary to complement KT with another compression measure.

Regarding the number of articles included in this review, it is small even without applying any filters in the search (except for RCTs). This indicates that it is a topic that has been poorly investigated over the years and requires more studies, which is corroborated by the date of the first publication on this topic (2013) (24), as it is a relatively recent investigation. Additionally, most of the articles (23,24,26) belong to the same research group.

Also, as mentioned earlier, the search was limited to RCTs. This type of study is the most suitable for evaluating the effectiveness of a clinical intervention, allowing relative control of biases and knowledge of the magnitude of treatment effects on subjects (42). Despite this, it would be of interest to conduct other types of research that can provide new information.

From physiotherapy, there are multiple techniques that can help alleviate the symptoms of patients with CVI, promoting ulcer healing, improving muscle function and ankle mobility, as well as reducing edema (40). One of these would be myofascial techniques, which, in the study by Ramos et al. (43), demonstrated significant improvements in venous flow velocity, pain, or diastolic pressure, among others. On the other hand, hydrotherapy has proven to be effective in these patients, accelerating venous return, mobilizing extracellular fluid, and thus reducing edema (44). Additionally, it is an ideal environment for situations where pathology coexists with other comorbidities, such as obesity, as the flotation effect contributes to increased mobility and physical activity (44). Lastly, a program of various active exercises (resistance exercises with therabands, stability exercises, treadmill walking, etc.) also shows significant benefits in terms of ROM, muscle strength, pain intensity, and venous return velocity (45).

The main limitations of the present literature review are presented below. Firstly, the duration of the included studies is short. All interventions are conducted for 4 weeks with no follow-up measurements, so the long-term effects of KT are unknown. However, there are studies (46,47) that study the effect of compression stockings in the long term, between 1 and 3 years, providing favorable results. Therefore, it would be interesting to evaluate KT over longer periods of time.

Another major limitation of this review lies in the heterogeneity of the included studies, as different applications and cuts of the KT tape are used, making it difficult to standardize an application and compare results.

Following the Van Tulder criteria (20), the general scientific evidence published regarding the effects of KT on CVI is contradictory. This is because in various RCTs, which have high methodological quality, multiple variables show opposite effects. Regarding the effect of KT on reducing pain, there is solid evidence, as improvements were observed in 3 studies (23,24,26), all of high methodological quality.

On the other hand, there is contradictory evidence regarding the efficacy of KT for venous symptoms, as in 2 articles (24,26) swelling, heaviness sensation, and claudication improve, among others, while in the study by Naci et al. (25), there is no improvement in measurements of lower limb edema.

Likewise, regarding quality of life, there is also contradictory evidence, as no changes are observed in 1 study of high methodological quality (24), while in the other 2 (23,25), significant improvements are seen.

As for the venous pump function, the evidence is moderate, as it improves in only 1 RCT of high methodological quality (26).

In future research, standardization of KT application parameters would be required, as well as estab-

lishing the consequences of the placebo effect regarding pain. It would also be interesting to conduct longer studies that analyze the long-term effects of KT, in addition to comparing it with different treatment techniques that promote CVI improvement, such as exercise or hydrotherapy.

CONCLUSIONS

Currently, the overall evidence of the effect of KT on CVI is contradictory. There is solid evidence of the positive effects of KT on pain intensity and distribution, venous symptoms, quality of life, and venous pump function in patients with CVI. However, due to the observed differences between techniques, a direct relationship between KT properties and its mode of use cannot be established, making it impossible to standardize an ideal application.

The data indicate that the isolated use of KT in CVI cannot be prescribed because the most significant changes are observed when combined with compression stockings. Since the information obtained is scarce and contradictory, future research on the effects of KT on CVI, both short and long term, is required. At this time, the application of KT in isolation does not have sufficient scientific support, although it could be considered as an adjunct due to the positive results obtained on symptomatology, without reported adverse effects and at low cost.

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