Efficacy of Kinesio® taping in the treatment of lymphoedema after breast cancer: a systematic review

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Key words

Lymphoedema, Breast cancer, Kinesio® tape

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Abstract

It is estimated that up to 20% of patients diagnosed with breast cancer will suffer from lymphoedema after surgery and associated treatments. Recently, Kinesio® taping has been integrated with other modalities as an additional technique in the treatment of breast cancer-related lymphoedema. This review aimed to determine whether Kinesio® taping is an effective technique in the treatment of lymphoedema secondary to breast cancer. Based on published studies, the application of Kinesio® tape for therapeutic purposes has visibly positive results; however, it does not appear to be more effective than other treatments. In addition, the adverse effects relating to this therapy, such as skin irritation, could limit its application in practice.

Lymphoedema is a consequence of the altered balance between capillary filtration and lymphatic drainage. Clinically, lymphoedema is identified when the volume of lymph accumulated is more than approximately 10% above normal (Dylke et al, 2016). It is estimated that the incidence of upper limb lymphoedema secondary to breast cancer increases from 13.5% at 2 years to 41.1% at 10 years (Ribeiro et al, 2017). The long-term presence of lymphoedema is often associated with other pathologies and complications, such as infection, inflammatory reactions and tissue fibrosis.

Conservative non-pharmacological management is the treatment of choice of lymphoedema; its aim is to improve and control oedema, reduce associated symptoms and prevent complications (Millán, 2012). The latest consensus document from the International Society of Lymphology (2016) recommends complex decongestive therapy including manual lymphatic drainage (MLD), compression therapy, elastic garments, therapeutic exercise and skin care as an optimal treatment regimen.

Currently, there is a search for alternative techniques in the treatment of lymphoedema, such as Kinesio® taping (KT). This technique was developed by Dr Kenzo Kase and consists of elastic adhesive tape that activates blood microcirculation and lymphatic drainage. It elevates the skin, facilitating passage of lymph to the vascular system (Leng et al, 2019).

The purpose of the current literature review was to determine whether KT is effective when used alone or in combination with other therapies, in the treatment of breast cancer-related lymphoedema (BCRL).

Methods

In January and February 2018, a search of scientific articles in PubMed, Scopus and CINHAL electronic databases was performed. It used Medical Subject Headings (MeSH) such as "lymphedema", as well as key terms not included as MeSH, such as "kinesio tape", "taping" and "tape" (*Table 1*). Inclusion and exclusion criteria (*Table 2*) were applied to articles identified to identify those that were relevant. The PRISMA diagram of the search is shown in *Figure 1*.

Results and discussion

The search identified 14 relevant studies. The data extracted from these studies are given in *Table 3*. The papers were classified as follows:

- Randomised clinical studies (Smykla et al, 2013; Malicka et al, 2014; Pekyavaş et al, 2014; Pop et al, 2014; Darowska and Sliwinski, 2016; Melgaard, 2016; Taradaj et al, 2016)
- Case studies (Chou et al, 2013; Navarro and Sánchez, 2014; Taradaj et al, 2014; Lubińska et al, 2015)
- Quasi-experimental studies (Hubert et al, 2013; Lipinska et al, 2015; Martins et al, 2016).

Randomised clinical studies were evaluated using the PEDro scale. Melgaard (2016) scored the highest (8/11) and Pop et al (2014) the lowest (1/11). Most studies were of moderate to high quality based on Moseley et al (2002), who consider studies with a score >5 to be of moderate quality.

Sample sizes varied from 82 participants (Taradaj et al, 2016) to single case studies (Chou et al, 2013; Navarro and Sánchez, 2014; Lubińska et al, 2015). Studies with greater sample sizes are more representative

Table 1. Search terms used to identify relevant articles.

Database	Search terms
PubMed	"Lymphedema"[Mesh] AND "kinesio tape"
	"Lymphedema"[Mesh] AND "taping"
	"Lymphedema"[Mesh] AND "tape"
Scopus	(TITLE-ABS-KEE (lymphedema) AND TITLE-ABS-KEE ("kinesio tape"))
	(TITLE-ABS-KEE (lymphedema) AND TITLE-ABS-KEE (taping))
	(TITLE-ABS-KEE (lymphedema) AND TITLE-ABS-KEE (tape))
CINAHL	(MH "Lymphedema") AND "kinesio tape"
	(MH "Lymphedema") AND "taping"
	(MH "Lymphedema") AND "tape"

Table 2. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Articles published between 2013 and 2018	Literature reviews and meta-analyses
Publication language: English and Spanish	Studies that do not fit the objective
Articles including human subjects	Duplicate articles in different databases

than case studies, where results cannot be generalised (López, 2004).

Participants' ages were diverse. Of the 481 women included in the studies, the average age was 60 years. The age distribution is representative of breast cancer frequency, as described by DeCherney et al (2014), beginning in the 30s (1 in 2,000 women) and a percentage of 11.1% at 80 years.

Lymphoedema can result from different forms of breast surgery: conservative (Chou et al, 2013; Lubińska et al, 2015); radical (Smykla et al, 2013; Taradaj et al, 2014; Darowska and Sliwinski, 2016) and radical modified (Lipinska et al, 2015; Taradaj et al, 2016). Most studies combined women who had undergone conservative and radical procedures (Malicka et al, 2014; Navarro and Sánchez, 2014; Pekyavaş et al, 2014; Pop et al, 2014; Martins et al, 2016). Only Malicka et al (2014) analysed women with stage I BCRL; Melgaard (2016) and Chou et al (2013) studied stage II BCRL. Two articles (Pop et al, 2014; Darowska and Sliwinski, 2016) included women with stage I and II BCRL, while the majority recruited women with lymphoedema in stages II and III (Smykla et al, 2013; Navarro and Sánchez, 2014; Pekyavaş et al, 2014; Taradaj et al, 2016). There was a relationship between type of surgery and degree of BCRL: lymphoedema stages II and III were present in patients who have received modified radical and radical surgery (Navarro and Sánchez, 2014; Pekyavaş et al, 2014; Taradaj et al, 2016), whereas stage II lymphoedema was more common than stage III (Smykla et al, 2013; Taradaj et al, 2016).

The state of the axillary lymph nodes is described in Taradaj et al (2016, 2014) according to Berg levels. Only axillary lymphadenectomy is mentioned in seven articles (Chou et al, 2013; Smykla et al, 2013; Hubert et al, 2013; Lubińska et al, 2015; Darowska and Sliwinski, 2016; Martins et al, 2016; Melgaard, 2016). The remaining studies do not specify whether there is ganglion removal. Regardless of the surgical resection of lymph noes, most studies reported reductions in lymphoedema volume following treatment.

Most participants underwent radiotherapy or chemotherapy (Chou et al, 2013; Smykla et al, 2013; Pekyavaş et al, 2014; Taradaj et al, 2014; Lipinska et al, 2015). In four studies, women had previously received hormonal therapy (Malicka et al, 2014; Navarro and Sánchez, 2014; Martins et al, 2016; Taradaj et al, 2016). Most studies excluded patients who were receiving cancer treatment and required a period between adjuvant therapy and the intervention. They do not specify why, but it could be due to the effects of these vascular and lymphatic therapies, such as the 2–5% increase in lymphoedema (Ribeiro et al, 2017).

Only four articles (Hubert et al, 2013; Malicka et al, 2014; Lipinska et al, 2015; Martins et al, 2016) evaluate the effectiveness of KT itself; the rest incorporate KT in some way with the complex decongestive therapy. It is therefore difficult to analyse KT itself as a therapeutic strategy. There were differences in the direction of KT application – following the lymphatic flow from distal to proximal (Smykla et al, 2013; Taradaj et al, 2014) or *vice versa* (Navarro and Sánchez, 2014; Martins et al, 2016) or comparing both directions (Pop et al, 2014). The inventor of the method applies KT in distal to proximal direction (Leng et al, 2019), which coincided with a decrease in volume in studies included in the review (Smykla et al, 2013; Pop et al, 2014; Taradaj et al, 2014) with the exception of Martins et al (2016). Navarro and Sánchez (2014) applied KT in the near-distal direction and obtained positive results. Therefore, we cannot directly associate a specific application with positive results. It should be noted that Pop et al (2014) elevated the swollen limb prior to KT application, which can accelerate lymph flow by 15 times (Grądalski and Ochałek, 2000). The region of application also differed: five studies applied KT to the contralateral axillary region (Smykla et al, 2013; Taradaj et al, 2014 Lipinska et al, 2015; Darowska and Sliwinski, 2016; Martins et al, 2016); one in the homolateral inguinal region (Taradaj et al, 2016); two studies compared two different applications (Malicka et al, 2014; Pop et al, 2014). Theoretically, activation resulting from KT application to a region helps move lymph from a more to a less saturated area (Leng et al, 2019). As KT is always combined with complex decongestive therapy in these studies, so theory has not been proven.

The studies mainly measure BCRL through the calculation of volume (Chou et al, 2013; Hubert et al, 2013; Smykla et al, 2013; Malicka et al, 2014; Navarro and Sánchez, 2014; Pekyavaş et al, 2014; Taradaj et al, 2014; Lipinska et al, 2015; Martins et al, 2016; Taradaj et al, 2016) or limb circumference (Pop et al, 2014; Lubińska et al, 2015; Darowska and Sliwinski,

2016; Melgaard, 2016). Measurement tools used included the Optoelectric Perometer (Smykla et al, 2013; Taradaj et al, 2014, 2016), truncated cone formula (Chou et al, 2013; Navarro and Sánchez, 2014; Pekyavaş et al, 2014; Martins et al, 2016), the Limb Volumes Professional 5.0 program (Malicka et al, 2014), water-filled cylinder (Lipinska et al, 2015) and a measuring tape (Pop et al, 2014; Lubińska et al, 2015; Darowska and Sliwinski, 2016; Melgaard, 2016). This diversity of methods makes comparison of results difficult (Cuello et al, 2010). Manual measurement is most widely available but varies due to tape tension, thickness and measurement angle when compared to more accurate but less standard electronic methods (Chen et al, 2008; Cuello et al, 2010).

Twelve articles reported a reduction in the severity of BCRL with KT (Chou et al, 2013; Smykla et al, 2013; Malicka et al, 2014; Pekyavaş et al, 2014; Pop et al, 2014; Lipinska et al, 2015; Darowska and Sliwinski, 2016; Melgaard, 2016; Taradaj et al, 2014: 2016); two did not (Hubert et al, 2013; Martins et al, 2016).

Malicka et al (2014) and Lipinska et al (2015), who evaluated the use of KT in isolation, both obtained statistically significant reductions in BCRL ($p<0.05$). Pop et al (2014) also obtained positive results with KT but combined application with unspecified physical exercise, so the improvement cannot be attributed to KT exclusively. The remaining articles reported significant improvements in BCRL but all combined KT with complex decongestive techniques (*Table 3*). When positive results following KT are added to multilayer bandage use the results are even more significant with MLB (Navarro and Sánchez, 2014; Smykla et al, 2013; Darowska and Sliwinski, 2016; Taradaj et al, 2016). In Pekyavaş et al (2014), reductions in lymphoedema were more significant in the two groups that used KT. Chou et al (2013) reported that KT reduced arm circumference by almost 20 cm. The success of therapy cannot be entirely attributed to KT in Chou et al (2013), since the patient had renal pathology (which involves fluid retention), had received haemodialysis and refused to continue KT after developing skin damage.

Predictable percentages of lymphoedema volume reduction only exist for complex decongestive therapy — 25–73% (Bertelli et al, 1991). However, KT acts on the aqueous part of oedema (Leng et al, 2019) and resulted in significant reductions in:

- Stage I: Malicka et al (2014), Pop et al (2014), Darowska and Sliwinski (2016)
- Stage II: Smykla et al (2013), Navarro and Sánchez (2014), Pekyavaş et al (2014), Melgaard (2016), Taradaj et al (2016)
- Stage III: Chou et al (2013). This is notable as the largest component of lymph at this stage is protein, and the damage is considered irreversible (International Society of Lymphology, 2016).

The duration of studies finding reduced oedema with KT ranged in length from 10 days (Pekyavaş et al, 2014) to 8 weeks (Lubińska et al, 2015). Those with less than 10 days of intervention did not report reductions in oedema (Hubert et al, 2013; Martins et al, 2016). No evidence was found indicating the minimum time KT should be applied to achieve positive results.

Some authors incorporated physical exercise in their intervention, but did not specify the type (Chou et al, 2013; Pop et al, 2014; Darowska and Sliwinski, 2016; Melgaard, 2016). Due to lack of information, the benefit of exercise could not be judged when considering the impact of KT. There is no consensus about the length, type or intensity of physical exercise that should be recommended for patients with BCRL (López and De Carlos, 2010).

Limitations in upper limb range of movement were assessed with a goniometer in four studies (Pop et al, 2014; Lipinska et al, 2015; Darowska and Sliwinski, 2016; Taradaj et al, 2016); all but Pop et al (2016) showed a significant improvement following treatment. Grip strength, measured by a dynamometer, was significantly improved in two studies (Pop et al, 2014; Taradaj et al, 2016). A nonsignificant decrease in pain was noted with KT (Navarro and Sánchez, 2014; Pekyavaş et al, 2014). The improvement in range of motion and pain level could be a result of the decrease in limb volume (Hassan and Ismail, 2015).

It could be assumed that oedema

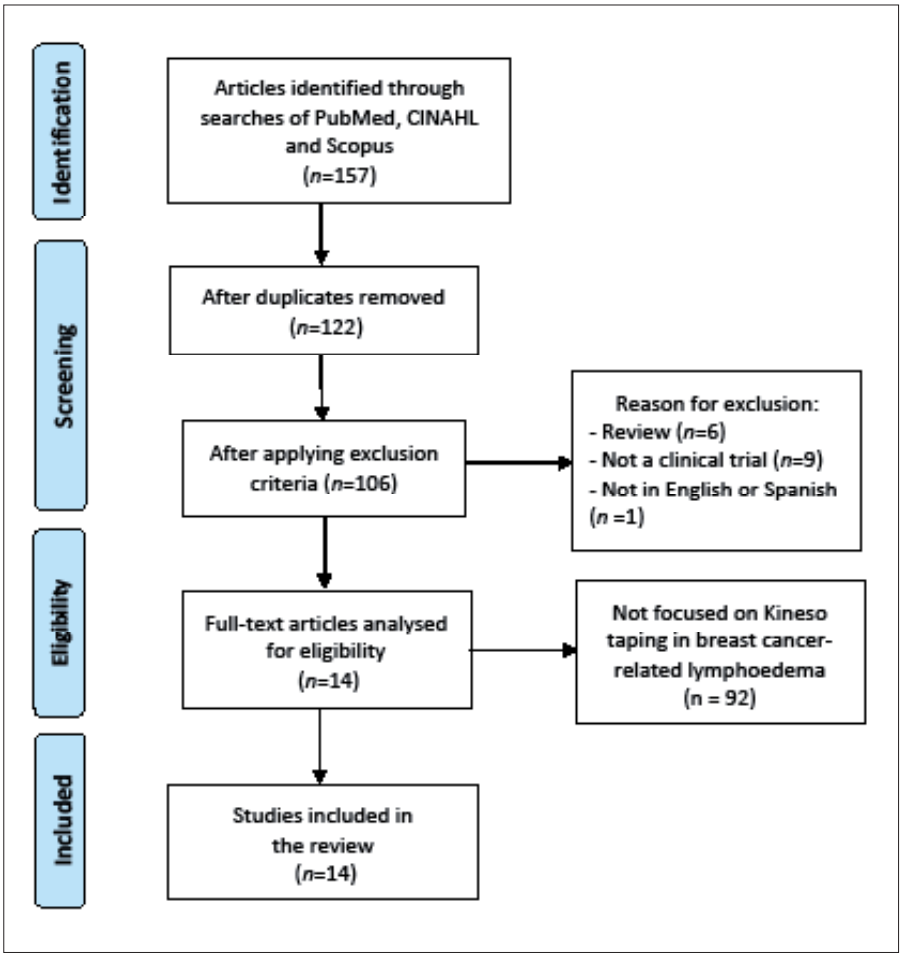

Figure 1. PRISMA diagram of the literature search.

Table 2. Results.

Study	Participants	Stage	Age	Measurements	Treatment protocol	Assessments	Duration	Outcomes
Malicka et al, 2014	28: • SG1: *n*=7 • SG2: *n*=4 • CG3: *n*=14	I	Average: 59.75	Circumference: measuring tape Volume: Limb Volumes Professional 5.0 program	• SG1: KT in individual fan shapes at arm and forearm and anastomosis • SG2: KT in a double fan shapes at arm and forearm	Before, after 2 and 4 weeks	4 weeks 1 application per week	SG1 and SG2: significant reduction in extension of lymphedema (p=0.009); CG: no significant reduction (p=0.36)
Taradaj et al, 2016	82: • G1: *n*=22 • G2: *n*=23 • G3: *n*=25	II and III	Average: 61.97	Volume and circumference ROM: goniometer Grip strength: dynamometer	• G1: MLD + pneumatic drainage + KT • G2: MLD + pneumatic drainage + quasi-KT • G3: MLD + pneumatic drainage + MLB	Before and after the intervention	4 weeks MLD: 50 min, 3 times/week Pneumatic drainage: 45 min, 3 times/week KT: every 4 days MLB: daily	Significant difference in the volume decrease, ROM and strength in the 3 groups, more pronounced in G3
Darowska and Sliwinski, 2016	24: • G1: *n*=12 • G2: *n*=12	I and II	Range: 47–65	Circumference: measuring tape Pain: VAS ROM: goniometer	• G1: MLD +TE + KT • G2: MLD + TE + MLB	Before and after the intervention	2 weeks MLD: 30 min ET: 20 min KT: at the beginning and every 5 days MLB: daily	Significant decrease in perimeter, pain and ROM in both groups, the first two items most evident in G2 and the last one in G1
Lipinska et al, 2015	73	-	Range: 31–71	Volume: water displacement ROM: goniometer	SG- KT	Before and every 5 days until 2 weeks	2 weeks KT: at the beginning and every 5 days	Significant difference in volume between 1st and 2nd measurements but not in following ones. ROM improved significantly in all measurements
Smykla et al, 2013	65: • SG1: *n*=23 • SG2: *n*=20 • CG3: *n*=22	II and III	Range: 44–80	Volume: Optoelectronic Perometer 40 T	• G1: Pneumatic drainage + MLB • G2: Pneumatic drainage + KT • G3: Pneumatic drainage + cuasiKT	Before and after the intervention	4 weeks Pneumatic drainage: 45 min Applications: 3 times/week	Significant volume reduction in the 3 groups, more pronounced in G1
Martins et al, 2016	24	-	Average 67.4	Volumetry: volume Frustum formula Functionality: Quick DASH Dermal changes	KT applied in anterior and posterior axillo-axillary anastomosis, from proximal to distal in upper limb Guideline on bandage handling and care	Before and after the intervention	5 days	No significant differences in volume, but improved functionality. Adverse reactions: 1 × skin lesions, 10 × itching, 1 × pain. 70% felt treatment was safe. 75% did not present difficulties in activities of daily living and felt satisfied with treatment
Melgaard, 2016	10: • G1: *n*=5 • G2: *n*=5	II	Average 62.5	Circumference: measuring tape QoL: focus group interview Costs	• G1: MLD + TE +MLB • G2: MLD + TE + KT Skin care to both groups	Before and after the intervention	4 weeks MLB: 5 times/week KT: 2 times/week	Significant differences in favour of KT in 2 of the 7 levels evaluated QoL testimonies in favour of KT Costs were higher for the KT

Table 2. Results (continued).

Study	Participants	Stage	Age	Measurements	Treatment protocol	Assessments	Duration	Outcomes
Pekyavas et al, 2014	45: • G1: *n*=15 • G2: *n*=15 • G3: *n*=15	II and III	Average: 49.6	Pain by VAS QoL: SF-36 scale Volumetry: volume Frustum formula	• G1:CDT + MLB • G2:CDT + MLB + KT • G3:CDT + KT	Before and after the intervention Follow-up 1 month after the intervention	2 weeks CDT: • MLD: 30 min • Exercises: 20 min • Skin care 5 times/week for 2 weeks	No significant differences in symptoms Volume decreased significantly in the 3 groups, with intergroup differences in favour of G2 QoL improved for G1 and G
Lubińska et al, 2015	1	-	67	Circumference: centimeter tape	MLD + KT	Before and after the intervention	8 weeks MLD + KT: 60 min 1 time/week	Circumference reduced by 2 cm in the forearm and 1 cm in the elbow and wrist and remained at the metacarpal level
Pop et al, 2014	44: • G1: *n*=22 • G2: *n*=22	I and II	Range 63–64	Circumference: centimeter tape ROM: goniometer Grip strength: dynamometer	• G1: KT (distal to proximal) + TE previous swollen limb elevation 20 min • G2: KT (proximal to distal) + TE	Before and after the intervention	3 weeks TE: 5 times/week KT: 1 time/week	Decrease in oedema: 55% in G1 versus 27% in G2 Shoulder ROM improved in both groups Improvement in strength: 8 kg in G1 *versus* 5 kg in G2
Taradaj et al, 2014	1	-	62	Volume: Optoelectronic Perometer 400 T	Pneumatic drainage + MLD + diaphragmatic breathing exercises + KT KT applied from the anterior aspect of the hand, arm and forearm to chest (distal to proximal)	Before and after the intervention	3 weeks Pneumatic drainage: 12 × 45 min MLD: 12 × 50 min KT: 3 applications	Volume significantly reduced by 62 cm^3
Chou et al, 2013	1	II	48	Volumetry: volume Frustum formula	MLD + TE+ KT (from arm to axilla, distal to proximal) + skin care	Before, 6 weeks later and after the intervention	4 weeks MLD: 45 min 3 times/week	Circumference reduced by 20 cm; volume decreased >400 ml Side-effects: itching and appearance of itching and wounds
Navarro and Sánchez, 2014	3: • G1: *n*=1 • G2: *n*=1 • G3: *n*=1	II and III	Range: 50–62	Pain: VAS Circumference: centimetre tape Volumetry: volume Frustum formula	• G1: MLD + pneumatic drainage + MLB • G2: MLD+ pneumatic drainage +KT (proximal to distal) • G2: MLD + pneumatic drainage + MLB + KT (proximal to distal)	Before and at the end of each of the 3 weeks	3 weeks MLD: 30 min Pneumatic drainage: 30 min	Volume decrease at end of treatment: • 80.2% in G1 • 15.4% in G2 • 19.7% in G3
Hubert et al, 2013	14	-		Volume: not specified QoL: FACT-B scale Satisfaction: VAS	Days 1–5: compression sleeve Days 5–9: KT	Before and after the intervention	9 days	No statistically significant differences in volume, QoL or satisfaction

CDT = complete decongestive therapy; CG = control group; DASH = disabilities of the arm, shoulder and hand; FACT-B = Functional Assessment of Cancer Therapy – Breast; KT = Kinesio taping; MLB = multilayer bandage; MLD = manual lymphatic drainage; QoL = Quality of Life; ROM = range of motion; SG = subgroup; TE = therapeutic exercise; VAS = visual analogue scale

reduction has a positive influence on the quality of women's life (Aguirre et al, 2017). Quality of life was assessed using Short Form-36 survey (Pekyavaş et al, 2014), Functional Assessment of Cancer Therapy – Breast Cancer version 4 (Hubert et al, 2013) and open interview (Melgaard, 2016). Satisfaction with KT treatment varied: it was poor in Hubert et al (2013) but high in Pop et al (2014). These findings leave ambiguity about the impact of KT on quality of life.

KT therapy did have some negative side effects. Martins et al (2016) recorded 10 cases (42%) of skin reactions to KT. In the case study presented by Chou et al (2013), the patient stopped KT treatment after developing skin damage. Tension, tightness and discomfort following KT application were reported by study participants (Navarro and Sánchez, 2014) and 18 patients in Martins et al (2016) removed KT due to discomfort. The use of an adhesive tape on oedematous skin may therefore not be the best option (Tsai et al, 2009).

It is difficult to draw firm conclusions about the role of KT within BCRL management from the studies included in this review, as their methods and findings are very diverse. Some concluded KT with complete decongestive therapy (CDT) had a positive impact on BCRL (Pop et al, 2014; Taradaj et al, 2014; Lipinska et al, 2015; Melgaard, 2016). A number considered KT a possible alternative to conventional treatment (Malicka et al, 2014; Navarro and Sánchez, 2014; Pekyavaş et al, 2014; Lubińska et al, 2015). Chou et al (2013) considered KT an alternative to compression treatments. Darowska and Sliwinski (2016) state that MLB can be totally replaced with KT. Interestingly, although Martins et al (2016) and Hubert et al (2013) did not find significant improvements with KT, they note that it reduced the volume of lymphoedema. In contrast, Smykla et al (2013) and Taradaj et al (2016) conclude that KT is not effective and cannot replace MLB, despite finding that KT significantly improved BCRL. They do not clearly define how they arrive at this conclusion, but may have extracted it when comparing the KT group with the quasi-KT group, which obtained a non-significant result.

Limitations

This review had a number of limitations. There is the lack of standardised nomenclature for the use of KT, which made it difficult to identify studies that might be relevant. There were an insufficient number of eligible studies to extrapolate the results. This issue was compounded by the variety of treatment protocols, intervention times, techniques and instruments used to measure BCRL. The fact that many studies did not analyse KT separately, but as part of complex decongestive therapy, makes it difficult to determine the contribution of KT to lymphoedema reduction.

Conclusion

KT application in women BCRL resulted in reductions in limb volume. However, KT has not been proven more effective than other elements of CDT. The reported adverse effects of KT on skin could aggravate lymphoedema and may limit the application of this treatment in practice.

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