



Compression therapy: Unna boot applied to venous injuries: an integrative review of the literature

Terapia compressiva: bota de Unna aplicada a lesões venosas: uma revisão integrativa da literatura
Terapia compresiva: bota de Unna aplicada a lesiones venosas: una revisión integrativa de la literatura

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ABSTRACT

Objective: To analyze the literature related to the types of therapies for venous injuries with emphasis on use of the Unna boot, and to investigate and discuss the main aspects related to its use compared to other techniques. **Method:** Integrative review of the literature of the last five years through searches in the following databases: VHL, LILACS, BDENF, SciELO, MEDLINE/PubMed. **Results:** Twenty-two publications were identified, with 15,931 cases among adult or elderly individuals, whose mean age was 60 (35-78) years or greater with no sex differences. The Unna boot presented a shorter healing time than the single and two-layer elastic bandage. **Conclusion:** Although other compression techniques may prove to be more efficient than the Unna boot by adding more technology, the boot stands out as a traditional low-cost dressing. Multilayer bandage is a gold standard technique. This review demonstrated the best option may not be the Unna boot, because it requires a higher healing time compared to the multilayer bandage, but it meets the expectation with a high rate of treatment efficiency, also when compared to simple dressing, single or two-layer bandage.

DESCRIPTORS

Leg Ulcer; Varicose Ulcer; Venous Insufficiency; Compression Bandages; Wound Healing; Review.

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INTRODUCTION

The incidence of venous insufficiency (VI) of the lower limbs (LL) has significant worldwide growth, mainly due to longevity⁽¹⁾. This condition is characterized by partial or complete mechanical obstruction (thrombosis) that results in valve insufficiency and venous hypertension by causing instability between the flow and reflux in blood vessels. The following are among the main risk factors: diabetes, hypertension, obesity, traumas and smoking, as well as the female sex by the number of pregnancies or use of contraceptive medication⁽²⁾. Once the disease establishes, it can progress to wounds of difficult healing, incapacities, and still recur in up to 66% by making the condition chronic⁽³⁾. Feeling of weight, pain and itching in the lower limbs (LL)⁽⁴⁾ are often diagnosed clinical symptoms, and may be supplemented with Doppler-like imaging tests.

Venous ulcer is a prevalent disease in industrialized countries. The estimate is that 1% of the adult population may be affected by it⁽⁵⁾. In the United States, 6.5 million people are affected each year, which generates a cost of 3 billion annually to the health sector⁽⁶⁾. One of the main forms of prevention is maintaining proper eating habits, performing physical activity, raising legs above heart level for approximately 20 minutes, and wearing compressed elastic stockings as recommended by a trained health professional.

The main complication of chronic venous insufficiency is venous ulcer, which usually manifests in the lower third (malleolus) of the lower limbs, and healing can progress from six weeks to several years⁽⁷⁾. Venous ulcers are usually superficial, but depending on the picture, they go through various levels of aggravation. Stage I presents erythema, but the skin remains intact. In stage II, the skin loses thickness, and the dermis is exposed. In stage III, there is total loss of skin. In stage IV, there is total tissue loss, and the deep tissue region assumes a dark red, brown or purple color⁽⁸⁻⁹⁾.

Venous ulcer is one of the most relevant public health problems, especially in the Western Hemisphere⁽¹⁰⁾, with prevalence of 80% to 85%, and the rest of the wounds are diagnosed as arterial, mixed or neuropathic⁽¹¹⁾. In the United States, there are 2.5 million and in the United Kingdom there are approximately 580,000 individuals with wounds, which result in costs between 300 and 600 thousand pounds with health professionals⁽¹²⁾. In addition to the physical impact of chronic injuries on people, and the burden of material and human resources, there is psychosocial involvement⁽¹³⁾. In Brazil, it is estimated that 3% of the population has vascular injury in LLs, and it can reach 10% if the individual is affected by diabetes mellitus⁽¹⁴⁾. In Europe, one in every 1,000 people have the disease. It is common in the elderly, and about 20 out of 1,000 people acquire the disease after reaching the eighth decade of life⁽¹⁵⁾. Compression, topical, drug or surgical therapy are some of the treatments for wounds. Choosing the best option depends on the evaluation of a multidisciplinary team⁽¹⁶⁾ formed by physicians, nurses, physiotherapists, among others. Compression therapies can be elastic (stockings, single or multilayer bandage), inelastic (Unna boot) or intermittent pneumatic⁽¹⁷⁾.

The Unna boot is a form of therapy with compression of 18-24 mmHg. Its composition can vary from the traditional form that requires previous thermal heating, and the industrial, ready-to-use form, which is the most used, slightly divergent in components and contains 10% of zinc oxide, gum acacia, glycerol, castor oil and deionized water⁽¹⁸⁾. This technique was developed in 1896 by the German dermatologist Paul Gerson Unna⁽¹⁹⁾. The Unna boot should be changed between every three to seven days, and the procedure is performed by the nursing or physician, depending on exudate and edema⁽²⁰⁾. If the therapy is not applied correctly, it becomes ineffective for venous hypertension control, increases the recurrence rates of ulcers and implies complications. The Unna boot is wrapped around the leg, calf and foot. During rest and muscle contraction, there is compression, as it acts on macrocirculation by increasing venous return, and on tissue pressure by favoring the reabsorption of edema and the return of fluids located in interstitial spaces in the interior of the vascular and lymphatic system, which promotes healing of the injury and prevents inflammation⁽²¹⁾.

This treatment has shown good results. The expectation of cure in three months is 40% to 60% and, from six months to one year, it can reach 70%⁽²²⁾. Among the therapy benefits, are protection against trauma and minimal interference in daily activities. However, it is contraindicated in cases of mixed ulcers, swelling, erythema⁽¹⁸⁾, bedridden, wheelchairs and inflammatory process in the injury⁽¹⁹⁾.

Wound monitoring should be individualized and dynamic. It requires an intense knowledge and commitment from professionals⁽⁹⁾, since the injury responds differently to each type of product associated with compression. After the end of the ulcer treatment with the Unna boot, the use of compression stockings in order to avoid relapses is indicated⁽²³⁾.

The aim of this study was to identify, characterize, describe and analyze the literature related to the types of compression therapies in venous injury by emphasizing the use of the Unna boot and its impact on health practice and care in order to reconstruct the current knowledge on the subject. By considering the importance of expanding knowledge and reflection on the subject, it was necessary to review the scientific production based on the integrative review in order to examine the approached theme, assistance protocols, professional aspects, survey of the biopsychosocial characteristics involved and comparison between therapies.

METHOD

The present study was conducted based on an integrative review of the literature in order to list the bibliography with different methodological approaches on compression therapies in venous injury focused on use of the Unna boot. A methodological guideline of six segments was followed in order to perform the review, as follows: 1. identification of the theme, 2. selection of the hypothesis or research question, 3. establishment of criteria for inclusion and exclusion of studies, sampling and search in the literature, 4. definition of the information to be extracted from the selected studies and categorization of studies; 5. evaluation of included studies; 6. interpretation of results, presentation of the review and synthesis of knowledge⁽²⁴⁾.

The topic chosen and the question to be answered addressed the scientific knowledge produced, the applications of compression therapy in venous injury, especially the use of the Unna boot. In health publications, the available evidence in the literature was investigated, and the main aspects related to use of the Unna boot were discussed, compared to other techniques applied in venous ulcer with emphasis on the boot effectiveness reduction of edema and healing. The justification for the limitation of the search period of studies between 2012 and 2016 is that it provided a current and objective character to the study.

The data collection period was the first half of 2017, and the aim was to select publications for analysis and subsequent study. The following databases were used: Virtual Health

Library (VHL), Latin American and Caribbean Literature in Health Sciences (LILACS), Brazilian Nursing Database (BDENF), Scientific Electronic Library Online (SciELO), US National Library of Medicine National Institutes of Health (PubMed) and Medical Literature Analysis and Retrieval System Online (MEDLINE). As shown in Chart 1, the descriptors were crossed in each database. In PubMed, the 'MeSH Terms' descriptors were maintained in English only, since the included articles are in this language.

The descriptors (boot, unna, varicose, ulcer, therapy, compression, venous, leg, bota, úlcera, varicosa, terapia, compressiva, venosa, compressiva and la pierna) and keywords (unna, boot and bota) were combined in a variety of ways in order to guarantee diversity in the search.

Chart 1 – Crossings of terms according to the selected databases in English, Portuguese and Spanish.

Database	Language	Crossings
BDENF, LILACS, MEDLINE, SciELO	English	boot AND unna OR varicose ulcer/therapy OR compression therapy venous leg
		unna boot AND varicose ulcer/therapy AND compression therapy venous leg
		unna boot AND varicose ulcer/therapy OR compression therapy venous leg
		unna boot OR varicose ulcer/therapy AND compression therapy venous leg
	Portuguese	bota AND unna OR Úlcera varicosa/terapia OR Terapia compressiva venosa na perna
		bota unna AND Úlcera varicosa/terapia AND Terapia compressiva venosa na perna
		bota unna AND Úlcera varicosa/terapia OR Terapia compressiva venosa na perna
		bota unna OR Úlcera varicosa/terapia AND Terapia compressiva venosa na perna
	Spanish	bota AND unna OR Úlcera varicosa/terapia OR Terapia compresiva venosa en la pierna
		bota unna AND Úlcera varicosa/terapia AND Terapia compresiva venosa en la pierna
		bota unna AND Úlcera varicosa/terapia OR Terapia compresiva venosa en la pierna
		bota unna OR Úlcera varicosa/terapia AND Terapia compresiva venosa en la pierna
PubMed	English	boot[All Fields] AND unna[All Fields] OR "varicose ulcer/therapy"[Mesh Terms] OR (compression[All Fields] AND ("therapy"[Subheading] OR "therapy"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND ("veins"[MeSH Terms] OR "veins"[All Fields] OR "venous"[All Fields]) AND ("leg"[MeSH Terms] OR "leg"[All Fields])
		unna[All Fields] AND boot[All Fields] AND "varicose ulcer/therapy"[Mesh Terms] AND (compression[All Fields] AND ("therapy"[Subheading] OR "therapy"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND ("veins"[MeSH Terms] OR "veins"[All Fields] OR "venous"[All Fields]) AND ("leg"[MeSH Terms] OR "leg"[All Fields])
		unna[All Fields] AND boot[All Fields] AND "varicose ulcer/therapy"[Mesh Terms] OR (compression[All Fields] AND ("therapy"[Subheading] OR "therapy"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND ("veins"[MeSH Terms] OR "veins"[All Fields] OR "venous"[All Fields]) AND ("leg"[MeSH Terms] OR "leg"[All Fields])

Inclusion criteria were scientific articles available in full in the main scientific research sites on the internet with free access, available in Portuguese, Spanish or English, and that addressed the use of compression therapy with focus especially on use of the Unna boot as a descriptor of the area of interest.

According to criteria, among the highlighted works, those that did not respond to the objective of this review were excluded, as well as book chapters, manuals, literature reviews, editorials, reviews, course papers, theses, dissertations or papers presented at scientific events. A limit of the year of publication of articles (between 2012 and 2016) was established. The selection, reading and evaluation of studies was performed thoroughly, first through titles and abstracts and, finally, in full in order to group the studies related to compression therapy, especially to the Unna boot, that met the mentioned inclusion criteria.

The method used to group the data was a spreadsheet containing information about authors and year of publication of the study; database; place of development; language of publication; aims; methodology; results and conclusions of studies.

The final synthesis was presented descriptively by considering the objectives, results and conclusions obtained in each study. These data were classified and recorded by similarity and ordered in thematic categories. The process of identification, selection and inclusion of the primary studies was performed in three steps, as shown in Figure 1. In the first step, were excluded 188 duplicate articles out of the 1,814. In the second step, were selected 193 articles after reading 1,626 titles and abstracts. The third step included careful reading of 49 articles in full, out of which 27 were eliminated because they did not answer the guiding question of the present review. Therefore, 22 relevant articles were included in this final sample.

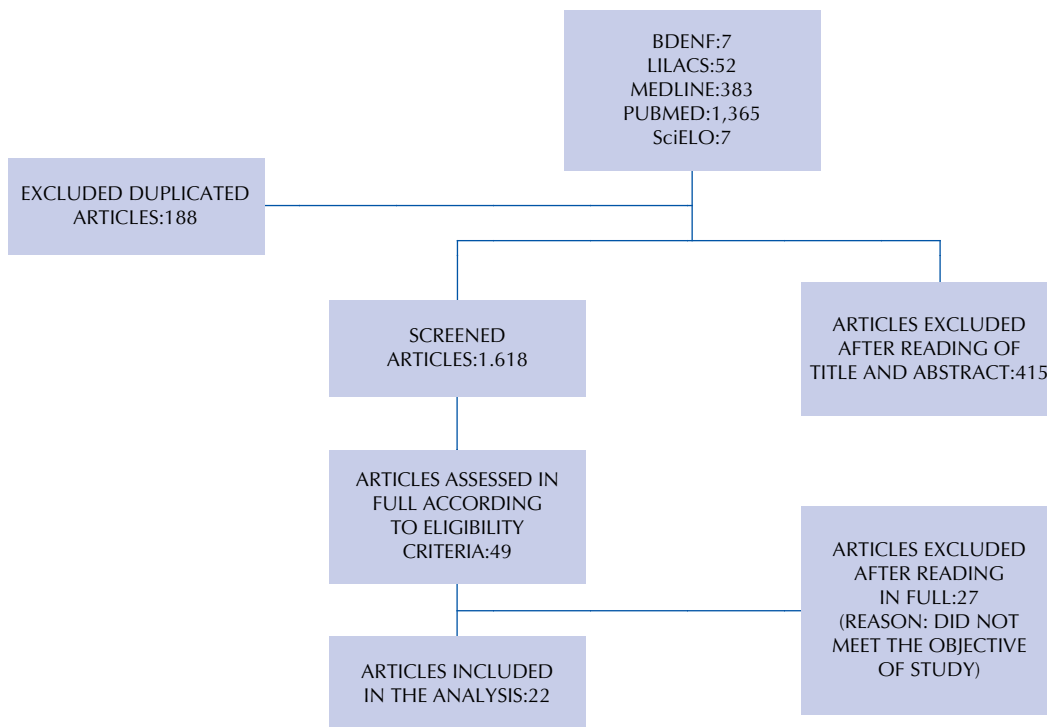


Figure 1 – Flowchart of identification, screening and inclusion of integrative review studies.

RESULTS

For the development of the integrative review the methodological course of six steps was followed. The final sample had 22 articles, as shown in Chart 2, encompassing 15,931 individuals aged 35 years or over. Eleven studies (50%) included participants from South America^(18-19,25-33), four (18%) from North America⁽³⁴⁻³⁷⁾, four (18%) from Europe⁽³⁸⁻⁴¹⁾, one (4%) from Australasia⁽⁴²⁾, one from Asia⁽⁴³⁾ and another (4%) from Oceania⁽⁴⁴⁾. The longest follow-up time was 13 years⁽³⁵⁾, and the lowest time was 28 days⁽³³⁾. Only one article did not mention the defined period⁽⁴³⁾.

The articles were published in international journals, and predominantly in English, only four were in Portuguese^(25-26,32-33), and one in Spanish⁽¹⁹⁾. In all articles there was always an author from nursing departments or institutions. There were several study designs divided as follows; one of each (5%): longitudinal⁽¹⁸⁾, comparative analysis⁽³⁶⁾, qualitative analysis⁽³²⁾, case-control⁽²⁷⁾, descriptive⁽³³⁾ and observational⁽³⁵⁾; two of each (9%): cross-sectional^(26,44) and retrospective^(28,33); three of each (14%): cohort^(28,34,40) and case reports^(19,29,31); and eight (36%) clinical trials^(25,30,37-39,41-43), among which four (18%) were controlled trials comparing two or more types of compression therapies, and taking into consideration the rate of reduction or healing of the injury as an evaluation parameter, as described in Table 1.

With reference to the target population, samples included subjects affected or not by comorbidities (smoking, obesity, diabetes, hypertension). The female representation was 55% and the male was 45% of the total number of participants. In this review, the mean age of the sample was 35-78 years, and the highlight was the age above 60 years.

Among some reports on the limitation of studies, the following stood out: small number of participants^(19,35),

short duration, absence of blind method, absence of placebo⁽³⁸⁻³⁹⁾, impossibility of access to inactive medical records (deaths and absence of consultations in the last two years)⁽³³⁾ and participants' withdrawal⁽⁴²⁾. In relation to reduction of the wound area, the lowest rate was 5%⁽¹⁹⁾ and the highest was 96%⁽⁴²⁾.

In this review, seven types of compression therapies were mentioned, namely: the Unna boot (14 studies; 63%)^(18,25-35,44); single-layer bandage (five studies; 23%)^(26-27,40,42,44); two-layer bandage (two studies; 9%)^(37,44); three-layer bandage (two studies; 9%)⁽⁴³⁻⁴⁴⁾; four-layer bandage (one study; 5%)⁽³⁶⁾; use of stocking (five studies; 23%)^(18,25-30,34,41,44); intermittent pneumatic (two studies; 9%)⁽³⁸⁻³⁹⁾ latex free tubular bandage (one study; 5%)⁽³⁷⁾. In 11 studies (50%)^(18,28,30-31,36-39,41-43), some of these therapies were compared. The Unna boot was studied in 13 (60%) articles, of which 11 were conducted in Brazil^(18-19,25,26,28-33), and the others in the USA⁽³⁴⁾, Poland⁽³⁸⁾ and United Kingdom⁽⁴⁰⁾; in five of these studies (23%), the Unna boot was compared to another therapy^(28,30-31,34,44), and in eight (36%)^(18-19,25-27,29,32-33,35) only the boot was studied.

The Unna boot was tested with the simple dressing as control, which is not compressive, but composed of gauze, band and 0.9% physiological solution⁽¹⁸⁾. However, another five (23%) researchers described the results of using the Unna boot^(19,25,27,29,33) by adopting various forms of analysis in order to prove its efficiency for healing venous injuries. In a qualitative research⁽³²⁾, tests with compression therapy were not performed, and biopsychosocial and spiritual aspects involved in the person using the Unna boot were addressed. When the Unna boot was compared to other therapies, it demonstrated a shorter healing time than the single and two-layer elastic bandage^(30,41).

Table 1 – Summary of comparative studies included in the review according to authors, year of publication, amount and total of the sample, type of compression therapy compared and results.

Authors	Patients/ Total sample	Material	Results	
			HR (%)	RWR (%)
Dolibog et al., 2013 ⁽³⁸⁾	SVR: 12 DVR: 10 AVR: 12	IP	SVR: 25.0 DVR: 20.0	SVR: 41.2 DVR: 38.7
	SVR: 11	Stocking	SVR: 27.3 DVR: 6.0 AVR: 20.0	SVR: 42.1 DVR: 15.9 AVR: 39.2
	SVR: 10 DVR: 15	EB – 2 layers	SVR: 10.0	SVR: 18.8
Dolibog et al., 2014 ⁽³⁹⁾	17/29	MB	58.6	–
	16/28	IP	57.1	–
	17/30	Stocking	56.7	–
	6/30	Unna boot	20.0	–
	5/30	EB – 2 layers	16.7	–
Abreu et al., 2015 ⁽³⁰⁾	9/18	Unna boot	–	69.4
	9/18	Elastic bandage	–	42.3
Adderley U, 2014 ⁽⁴¹⁾	224/454	EB – 4 layers	71.0	–
	230/454	Stocking – 2 layers	70.0	–
So et al., 2014 ⁽⁴³⁾	NA/321	EB – 4 layers	–	85.8
		EB – single	–	86.3
		No compression	–	33.5

Abbreviations: SVR: superficial venous reflux; DVR: deep venous reflux; AVR: associated venous reflux (Superficial and Deep); HR: healing rate; RWR: rate of wound reduction; NA: not available; IP: intermittent pneumatic; EB: elastic bandage; MB: multilayer bandage; UB: Unna boot.

Among the results and benefits of using compression therapy in venous ulcers, eight articles (36%) indicated the effectiveness of the Unna boot in control of edema, reduction of wound area and wound healing, and for improving patients' quality of life^(18-19,25,27,29,32-34). In two studies (9%), the low rate of indication of this therapy by professionals was criticized^(26,40). In four articles (18%), the authors emphasized the

efficiency of the multilayer bandage^(35,38,42-43), in two (9%) of the trials, one author argued for the efficiency of intermittent pneumatic compression^(35,38), besides mentioning the benefits of the single-layer bandage in two literatures (9%)⁽³⁹⁻⁴⁰⁾. In other four articles (18%), the two-layer bandage was considered effective^(34,39-41), and in one (5%) the elastic stocking was considered effective⁽³⁸⁾. One study presented no evidence⁽²⁸⁾.

Chart 2 – Summary of the characteristics of studies included in the review according to authors, article title, year of publication, social network studied, main results and recommendations and conclusions.

Author and year	Study Design; period and country	Sample	Prevailing age	Sex (%)	Results
Luz (2013) ⁽¹⁸⁾	Longitudinal, prospective, exploratory and quantitative; 2008; Brazil	32	> 60	F= 65 M= 35	The Unna boot accelerated healing, but compared to the simple dressing had equal efficiency. Contrary to what is expected in the literature, the author considers this result is a consequence of the high rate of patients' absence in assessments.
Salomé (2012) ⁽²⁵⁾	Clinical, descriptive and analytical trial; 2010-2011; Brazil	50	> 60	F= 52 M= 48	After eight months with the Unna boot, 84% of injuries healed, and patients showed improvement in their quality of life indexes.
Sant'ana (2012) ⁽²⁶⁾	Descriptive, cross-sectional and quantitative; 2009-2010; Brazil	58	≥ 50	F= 33 M= 67	Low use of the Unna boot (3.9%), treatment in disagreement with international recommendations (wound cleaning), need for multiprofessional intervention and effective accountability of nurses in the wound dressing room.
Lima (2013) ⁽²⁷⁾	Analytical, case-control; 2010-2011; Brazil	50	> 60	F= 52 M= 48	After eight months using the Unna boot, there was improvement in patients' functional capacity score for performing daily activities and in clinical and sociodemographic characteristics.
Scotton (2014) ⁽²⁸⁾	Cohort and retrospective; 2000-2010; Brazil	94	≥ 60	F= 72 M= 28	The Unna boot was used in 40% of the sample, but the evidence was not enough to determine what provided its benefit. Poor use of compression therapy and prolonged duration of antibiotic use were correlated with poor prognosis for cure. Multilayer compression (gold standard) was not available in the Brazilian health system – SUS (study site) for comparison.
Santos (2015) ⁽²⁹⁾	Case report; 45 days; Brazil	1	35	F= 1 M= 0	Quantified the photographic evolution of healing according to the tissue injury characterization by comparing the aspect of the adjacent skin. With use of the Unna boot, the ulcer brightness increased from 110 to 159 pixels and reached 203 post-healing. The edge of the ulcer had an increase from 117 to 137 pixels post-healing.

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Author and year	Study Design; period and country	Sample	Prevailing age	Sex (%)	Results
Abreu (2015) ⁽³⁰⁾	Clinical, controlled and randomized trial; 2011; Brazil	19	≥ 55	F= 42 M= 58	The Unna boot was the best product compared to the use of elastic bandage for reduction of injury area and of exudate. In greater wounds, elastic therapy showed results only after the fifth week. In both options, there was improvement of the injury, pain and edema. The recommendation was to change the secondary dressing daily for preventing odor (Unna boot), and the elastic bandage should be removed before bedtime and replaced in the morning.
Pereira (2016) ⁽³¹⁾	Case report; 63 days; Brazil	3	≥ 50	F= 1 M= 2	The single-layer elastic bandage was more cost effective and reduced healing time. Savings of 82% compared to multilayer. The ulcer with greater diameter (210 cm ²) reduced by 22.2% with multilayer bandage in only 62 days (faster), in addition to reducing pain and improving mobility. Elastic therapy seemed to be more effective than the Unna boot (time).
Lima, (2014) ⁽³²⁾	Qualitative; 2013; Brazil	8	N.I.	F= 8 M= 0	People have many expectations about the effects of the Unna boot. The successes of therapy make women more optimistic, while failures lead to hopelessness. This indicates that nurses must identify biopsychosocial aspects, nursing diagnoses and implement measures for improving the quality of life.
Danski, (2016) ⁽³³⁾	Descriptive retrospective; 2007-2012; Brazil	49	57	F= 21 M= 28	After analyzing the medical charts, among patients who used the Unna Boot, the therapy was efficient in healing varicose ulcers in up to 12 weeks, especially those of small size. The size of the ulcer, presence of purulent exudate, intense volume of exudate and unaided ambulation were variables that interfered in healing. Application of the Unna boot after healing for 3-4 week periods was beneficial for preventing relapses.
Abreu, (2013) ⁽¹⁹⁾	Case report; 2 months; Brazil	1	64	F= 0 M= 1	The use of the Unna boot was effective in healing, reduction of pain, reduction of exudate and pruritus, hydration of the wound bed and edema. The nurse should focus on the prevention of new wounds and self-care practices with the injury. The importance of outpatient follow-up of patients by health professionals, including nurses and angiologists, was highlighted. Lack of patients' adherence to treatment may compromise tissue repair results. The use of elastic stockings should be indicated to avoid relapses.
Lullove, (2014) ⁽³⁴⁾	Cohort and retrospective; 2000-2013; USA	60	≥ 75	F= 55 M= 45	The two-layer Unna boot (Andover) improved all symptoms, demonstrated effectiveness for reduction of edema and wound size after 12 weeks, and improved adherence to treatment compared to no compression therapy. Professional qualification was emphasized as being fundamental.
Fox (2016) ⁽³⁵⁾	Prospective and observational; 28 days; USA	10	N.I.	F= 5 M= 5	The use of multilayer therapy reduced leg circumference and was associated with improved inversion/eversion. There was also improvement in total plantar dorsiflexion associated with leg pain and wound pain. These findings were not correlated with the percentage wound reduction.
Pham, (2012) ⁽³⁶⁾	Comparative analysis; 2009-2010; Canada	424	N.I.	N.I.	The findings differ from emerging clinics and economic evidence supporting the four-layer high compression therapy, and thus suggest another perspective on high compression practice. That is, when applied by trained nurses based on evidence and protocol, four and two-layer bandages offer comparable cost-effectiveness and monetary value.
Dabiri, (2015) ⁽³⁷⁾	Clinical trial – non-randomized – open, 14 weeks; USA	7	≥ 56	F= 3 M= 4	A latex free compression tubular elastic bandage with double layer was tested. There was an increase in the healing rate with use of the tubular material. All individuals have shown healing at the 4 th and 8 th week. The conclusion was that tubular elastic compression can be used safely in patients with venous leg ulcers. This type of therapy allows for the daily inspection of the wound, getting dressed, and is an option among conventional compression therapies.
Dolibog (2014) ⁽³⁸⁾	Prospective, randomized and comparative; 2010-2013; Poland	117	> 60	F= 66 M= 34	Pneumatic system, stocking and multilayer bandage showed efficiency compared to two-layer bandage and Unna boot.
Dolibog (2013) ⁽³⁹⁾	Prospective, randomized and clinical; 2010-2012; Poland	70	> 60	F= 56 M= 44	Pneumatic compression system was more efficient than stockings and compression bandage.
Petherick (2013) ⁽⁴⁰⁾	Cohort and prospective; 2001-2006; United Kingdom	14.000	> 70	F= 63 M= 37	Low use of the Unna boot (<16%): socioeconomic gradient in disease, social inequality negatively associated with Doppler access and poor patient orientation on the disease.
Adderley (2014) ⁽⁴¹⁾	Open, randomized pragmatic clinical trial; 12 months; United Kingdom	454	N.I.	N.I.	The two-layer compression stocking and the four-layer bandage were compared. There was no significant difference between the average healing time. Average costs were around £300 per participant per year. Those who used stockings needed fewer nursing appointments. The findings suggest that stockings have a 95% chance of being more cost effective than four-layer bandage.
Finlayson (2014) ⁽⁴²⁾	Randomized and controlled; 2006-2009; Australia	103	≥ 60	F= 50 M=50	Compression systems were equally effective after 24 weeks, but the four-layer system response was faster. There was no difference in results of quality of life and pain. The injury size and the time of open wound influenced the prognosis.
So (2014) ⁽⁴³⁾	Randomized; N.I.; Hong Kong	321	≥ 60	N.I.	Compression is not known to nurses. Healing increases with compression compared to its absence. The efficacy of four-layer compared to single-layer was not determined. After the test of single-layer, no compression, and four-layer, the conclusion was that compression reduces the size of the ulcer and also acts on pain.
Zarchi, (2014) ⁽⁴⁴⁾	Cross-sectional study; 2011-2012; New Zealand	-	-	-	Compression was compared, indicating that many do not receive adequate therapy. When applying the inelastic bandage, there was a disparity among nurses in relation to obtaining the ideal pressure. However, application of the two-component compression bandage led to a considerably higher mean pressure (41.9 mmHg pressure) compared to the others. Suggestion to conduct training in the area, since the time of experience in the sector did not guarantee the proper application of the technique.

DISCUSSION

Elastic or inelastic compression therapy is the most recommended method for treating venous ulcers⁽⁵⁰⁾. As reinforced by authors of the Cochrane database in 2012, there was an increase in healing rates compared to no compression⁽²⁹⁾. Since ancient times⁽⁵¹⁾, and after the year 1628, when a physician related venous stasis with external pressure, elastic stockings of the most varied components were produced, such as resin bandages, natural fibers, cellulose (silk, cotton, coconut) and chemicals (acrylic, nylon, polyester)⁽⁵²⁾. This technology has undergone constant advances by promoting several benefits, such as venous return aid⁽⁵³⁾, the reduction of pain and leg circumference, the influence in exudation of lymphatic flow fluids, and the attenuation of venous hypertension⁽³⁶⁾. Several studies in the area pointed the increased use of compression therapy over time⁽⁴⁰⁾.

In this study, there was homogeneity in relation to the sex variable in the sample, with 55% of women, as described in other literatures^(25,27,30,33-34,39,42), but in opposition to another study, in which there was 67% prevalence of men⁽²⁶⁾. This difference can be explained by women's predisposition to varicose veins associated with age and body mass index (BMI), as well as hormonal changes^(35,53). The increase in life expectancy increases the number of elderly patients⁽²⁹⁾ who are prone to ulcers because of malfunctioning of the vascular system. Regarding the predominant age of this review, the results were similar to those found in the literature^(18-19,25,27-28,38-39,42-43,54).

Brazilian and international guidelines⁽⁵⁵⁾ recommend the adoption of the Doppler ultrasound examination for the diagnosis of leg ulcers. Although the equipment cost is viable, this evidence has rarely been documented in the literature, and in Europe, there were reports in agreement with this fact in a developed country like the United Kingdom⁽⁴⁰⁾. This reality may also be that of other localities. The treatment of venous ulcers requires long term follow-up, results in physical, functional, emotional and financial problems for patients⁽¹⁸⁾, in addition to generating costs for health reserves and causing obvious socioeconomic impacts.

The main anatomical location described for ulcers was the malleolar region, which is in line with the literature⁽¹⁹⁾. The duration of ulcers' evolution (in months) ranged from a minimum of two to a maximum of 792 months. A comparison of the Unna boot with a two-layer bandage⁽³⁴⁾ indicated a minimum of four and a maximum of 120 months, and the duration of ulcer was associated with age⁽¹⁸⁾. The healing time of injuries was 94 months, on average⁽⁵⁴⁾.

"The choice of dressing type in cutaneous wounds depends on assessment of patients and the wound appearance. There are many coverage options available in the market". In this review, studies that tested the application of the different therapies used worldwide were found. In each region, there is a tendency to use a certain technique, and this choice is based on the cost-benefit and availability of the product. There was a strong trend related to the socioeconomic aspects of a territory⁽²⁵⁾.

According to this review, the type of treatment varied by region. In two studies conducted in Poland⁽³⁸⁻³⁹⁾, prevailed the

use of multilayer, double or single-layer bandage, stockings and pneumatic compression, which acts in deep veins by promoting prophylaxis of thrombosis and influencing fibrinolysis, tissue oxygenation, edema and venous return⁽³⁹⁾. There is no possibility of implementing intermittent therapy in economically disadvantaged places. In addition to the high cost of equipment, the absence of electric energy makes it unfeasible. In one study, there was more ulcer recurrence among those who used bandage rather than stockings hence its use on an enlarged scale would provide substantial resource savings⁽⁴¹⁾. In a study conducted in Hong Kong⁽⁴³⁾, the four-layer and two-layer bandage were compared to non-compression bandage. In another study in Australia⁽⁴²⁾, the four and two-layer therapy were compared. It was not possible to conclude that the four-layer bandage was more effective than single-layer bandage, but compression therapies indicated better healing results than no compression. Such results were associated with faster responses in injury reduction^(29,43). Currently, multilayer bandage is considered the gold standard for the treatment of venous ulcers because it reduces healing time⁽³⁰⁾ compared to other therapies, but it is not available in the Brazilian Health System and is high costly⁽²⁷⁾.

In articles analyzed in this review, the authors showed the use of two-layer bandage in the United Kingdom⁽⁴⁰⁻⁴¹⁾, the use of two-layer and multilayer bandage, and the Unna boot in the United States^(34,36,37), and two and four-layer bandage in Canada⁽³⁶⁾. In New Zealand, attention was drawn to a study in which nurses applied compression therapies, and there were technical failures of the professionals.

According to the analysis, there was a significant improvement in quality of life, pain and self-esteem after the use of the Unna boot and healing of injuries by reaching the 84% rate of wound healing⁽²⁵⁾. Several authors^(18-19,25,27,29,32-34) advocate the use of the Unna boot for its effective healing properties and lower costs. Generally, patients who adapt to the boot technique achieve high levels of satisfaction related to minimal wound care, develop fast granulation, considerable levels of comfort⁽¹⁸⁾, besides the excellent aesthetic result⁽²⁹⁾.

As described in Table 1, the five controlled trials according to criteria defined in the methodology were tested and compared regarding the various compression techniques, among which the pneumatic, single and two-layer stockings, double and multilayer bandages, elastic bandage, Unna boot and no compression. Among them, the multilayer bandage and pneumatic bandage add more technology and cost, and the Unna boot, in turn, when compared to these, is inferior in healing time. However, when comparing the Unna boot to the single and two-layer elastic bandage, it was more efficient. The Unna boot was not widely used outside Brazil, which shows that other countries tend to use other techniques. As a compression therapy, the Unna boot was superior when compared to the single and two-layer bandage^(30,41).

In this review, few studies comparing techniques were found. There are many related variables, there is no homogeneity of tests of the Unna boot in the world, and they are focused on Latin America, while the bandages and stockings are focused on Europe and USA. Few studies in Brazil were controlled, there was predominance of case reports, longitudinal,

descriptive, cohort or qualitative trials. This may suggest that economic factors are decisive in compressive venous injury therapy. Controlled studies are often costly, so they may have been less frequent in developing countries, such as Brazil, where challenges regarding investment for research are faced.

The bandaging technique requires professional skill because “the intensity of the external compression applied to the lower limbs should decrease from the ankle to the knee in order to reverse the effect produced by prolonged orthostatism, that is, the increase of intravascular hydrostatic pressure”⁽²⁵⁾. However, if the technique is performed erroneously, it can either strangle or leave the bandage loose, which may compromise the effectiveness of the treatment.

Bandages act as a ‘physical barrier’ by protecting and isolating the injury from possible traumas. In relation to pain, as the Unna boot does not have elastomeric fiber, it does not shape any changes in leg volume, thus exerting pressure on the calf musculature, which can generate a possible discomfort during walking and rest⁽³⁰⁾.

Patient adherence to treatment is important to prevent relapse^(26,28). The high number of relapses may be related to non-adherence to preventive measures, such as the use of compression stockings after healing of ulcers, lack of post-healing monitoring with angiologists, among other factors^(26,30). Given the socioeconomic and territorial diversity of Brazil, in the Midwest region of the country, it was identified that 67% of patients had access to the mentioned specialist, unlike another author, who indicated the access of only 25.7% of patients in the Northeast region⁽²⁶⁾.

“In the international scenario, there is a trend of existing trained professionals for application of compression therapy and systematic follow-up, without necessarily restricting its indication by the medical professional, but, the evaluation should be performed by a vascular specialist in cases of people with altered ankle-arm index (less than 0.8), diabetes and lack of response in reducing the size of the injury after one month of compression therapy”⁽²⁶⁾. In Brazil, only the physician, usually the vascular specialist, is able to indicate the use of the Unna boot. The application and removal according to medical prescription is performed by the trained nurse or nursing technician, and the follow-up is under responsibility of the nurse together with the physician⁽⁵⁶⁾. After analysis of this review, and in agreement with the studies selected, the recommendation is that the “nurse be aware of the signs of new injuries” and skin changes during the nursing consultation^(26,56). The interaction of the trained

multidisciplinary team associated to the cooperation of patients is essential for treatment^(18,26).

CONCLUSION

The authors of the studied literature discussed the main aspects related to the use of compression therapies, in particular those of the Unna boot that was emphasized by its effectiveness in reducing edema and healing compared to other techniques applied to venous ulcer. From the analysis found in the journals, it was observed the improvement of scientific knowledge about compression therapies with presentation of their benefits in general. However, these techniques must be permanently studied, disseminated and compared with the objective of constant advances in the treatment of patients with venous ulcer. Still, the efficacy of such techniques is closely related to professionals’ training, multidisciplinary involvement, cooperation and patient adherence.

Although other compression techniques may prove to be more efficient than the Unna boot by adding more technology, the boot still stands out as a traditional low-cost dressing that reduces venous hypertension and edema, and favors the treatment of venous ulcers. The multilayer bandage is a gold standard technique in developed countries and has been widely used, but the Unna boot has also been used as an option for treatment of venous injury. This review showed that the Unna boot may not be the best choice because it requires a higher healing time compared to the multilayer bandage, but it meets the expectation with a high rate of treatment efficiency, even if compared to the simple dressing, and single and two-layer bandage.

The information obtained in the scientific literature has highlighted the effectiveness of the Unna boot by showing that for its efficiency, the therapy requires wide dissemination in scientific circles, new research and continuous and ongoing training of nursing professionals and physicians in order to increase confidence in its indication and handling. More assertive investments in health are needed both in public and private sectors, given the challenges faced in vascular injuries care. Success in the treatment of venous ulcers is multifactorial, depends on correct indication, professional evaluation, follow-up with wound measurement, association between therapies/products, rest, correct elevation of limbs, no manipulation of the patient, adhesion and correct wound cleaning. In terms of cost-benefit, the Unna boot is a great choice as a form of compression therapy, because it is affordable, available in SUS and requires low technology. Its benefits and efficiency overlap the possible discomforts.

RESUMO

Objetivo: Analisar a bibliografia relacionada aos tipos de terapias para lesões venosas, enfatizando o uso da bota de Unna, e investigar e discutir os principais aspectos relacionados ao seu uso, comparados aos de outras técnicas. **Método:** Revisão integrativa da literatura dos últimos 5 anos, por meio de buscas na BVS, LILACS, BDENF, SciELO, MEDLINE/PubMed. **Resultados:** Foram identificadas 22 publicações, com 15.931 casos entre adultos ou idosos, cuja média de idade foi igual ou superior a 60 (35-78) anos, sem discrepância na porcentagem de gênero. A bota de Unna apresentou um tempo inferior de cicatrização que a bandagem elástica simples e de duas camadas. **Conclusão:** Embora outras técnicas compressivas possam mostrar-se mais eficientes do que a bota de Unna, por agregar mais tecnologia, a bota se destaca por ser um curativo tradicional de baixo custo. A bandagem multicamada é uma técnica padrão-ouro. Esta revisão mostrou que a bota de Unna pode não ser a melhor opção, por demandar um tempo superior de cicatrização em comparação à bandagem multicamada, mas atende à expectativa com um alto índice de eficiência no tratamento, ainda se comparada ao curativo simples, bandagem simples ou de duas camadas.

DESCRITORES

Úlcera da Perna; Úlcera Varicosa; Insuficiência Venosa; Bandagens Compressivas; Cicatrização; Revisão.

RESUMEN

Objetivo: Analizar la bibliografía relacionada con los tipos de terapias para lesiones venosas, subrayando el empleo de la bota de Unna, e investigar y discutir los principales aspectos relacionados con el uso, comparados con los de otras técnicas. **Método:** Revisión integrativa de la literatura de los últimos cinco años, mediante búsquedas en la BVS, LILACS, SciELO, MEDLINE/PubMed. **Resultados:** Fueron identificadas 22 publicaciones, con 15.931 casos entre adultos o añosos, cuyo promedio de edad fue igual o superior a 60 (35-78) años, sin discrepancia en el porcentaje de género. La bota de Unna presentó un tiempo inferior de cicatrización que el vendaje elástico simple y de dos capas. **Conclusión:** Aunque otras técnicas compresivas puedan mostrarse más eficientes que la bota de Unna, por agregar más tecnología, la bota se destaca por ser un apósito tradicional de bajo costo. El vendaje multicapa es una técnica regla de oro. Esta revisión mostró que la bota de Unna puede no ser la mejor opción, al demandar un tiempo superior de cicatrización en comparación con el vendaje multicapa, pero atiende a la expectativa con un alto índice de eficiencia en el tratamiento, incluso si comparada con el apósito simple, vendaje simple o de dos capas.

DESCRIPTORES

Úlcera de la Pierna; Úlcera Varicosa; Insuficiencia Venosa; Vendajes de Compresión; Cicatrización de Heridas; Revisión.

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