Effectiveness of a precast adjustable compression system compared to multilayered compression bandages in the treatment of breast cancer-related lymphoedema: a randomized, single-blind clinical trial

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Abstract

Objective: To compare the effectiveness of a precast adjustable compression system with that of multilayered compression bandages in the treatment of breast cancer-related lymphoedema.

Design: Multicenter, randomized, single-blind parallel-group clinical trial.

Setting: The rehabilitation services of four general university hospitals.

Subjects: Patients with upper limb breast cancer-related lymphoedema.

Interventions: All the patients received manual lymphatic drainage, followed by a precast adjustable compression system or multilayered compression bandages, according to the group allocation. The treatment included 10 consecutive sessions over a two-week period from Monday to Friday, followed by some sessions on three alternate days per week, until the patient received a tailored compression garment.

Primary measurements: The patients were evaluated just before the treatment, after 10 sessions and at three months posttreatment. The primary outcome was the change in excess lymphoedema volume. Secondary outcomes were changes in the symptoms of pain, heaviness, tightness and hardness. Analyses were performed using an intention-to-treat approach.

Results: In all, 42 patients were included; there were 22 in the precast adjustable compression system group and 20 in the multilayered compression bandages group. Both groups exhibited significant decreases

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in excess volume and symptoms after 10 sessions and at three months. There were no significant differences regarding excess volume or symptoms between the precast adjustable compression system and multilayered compression bandages groups after 10 sessions and at the three-month follow-up exam.

Conclusion: The precast adjustable compression system and the multilayered compression bandages have similar efficacy for the reduction of excess lymphoedema volume or symptoms.

Keywords

Rehabilitation interventions, lymphoedema, breast cancer, conservative therapies

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Introduction

Lymphoedema is one of the main complications after surgery for breast cancer; this condition tends to progress and become chronic and has also been shown to worsen health-related quality of life.¹⁻³ Decongestive therapy is the core treatment for lymphoedema and consists of the following components: (1) manual lymphatic drainage, (2) compression, (3) exercises and (4) skin care.⁴

When the impact of each of these therapies on lymphoedema was analysed separately, the most effective proved to be multilayered compression bandaging.⁵ Multilayered compression bandages produce compression of the limb that decreases in the centripetal direction. The created gradient encourages the movement of lymphatic liquid towards the central circulation, thereby reducing the volume and hardness of the oedema.³ Multilayered compression bandages are applied using low-elasticity bandages over a soft foam-like material.⁶ If the bandage cannot withstand the appropriate pressure gradient, skin lesions or lymph accumulations may occur, which could worsen the evolution of the lymphoedema.^{3,7} Furthermore, part of the obtained pressure is lost during the first few hours following the application of the bandaging^{8,9} which reduces the effectiveness of the treatment.

The multilayered compression bandage technique requires careful application by expert professionals, making this approach a relatively costly treatment. Some patients are able to learn the technique and apply the bandage themselves, although this process can be very difficult for the elderly or those with limited mobility.

Some precast adjustable compression systems have been proposed as an alternative treatment for

lymphoedema. These systems allow easy application and removal for patients. They have been tested in patients with peripheral venous insufficiency and in patients with lower extremity lymphoedema and have proven to be effective and well tolerated.^{10,11} However, the effectiveness of a precast adjustable compression system on the upper extremities has yet to be demonstrated.

The objective of this study was to compare the effectiveness of a precast adjustable compression system with the effectiveness of multilayered compression bandages in the treatment of upper limb lymphoedema. The hypothesis was that precast adjustable compression system is as effective as multilayered compression bandages in the reduction of excess lymphoedema volume and symptoms control.

Methods

This was a multicenter, randomized, single-blind clinical trial to compare the effectiveness of a precast adjustable compression system with that of multilayered compression bandages in the treatment of upper limb lymphoedema. Four hospitals located in the metropolitan area of Barcelona participated in the study: Hospital Universitari Bellvitge (H1), Hospital Universitari Germans Trias i Pujol (H2), Hospital Mar-Esperança Parc de Salut Mar (H3) and Hospital Universitari Vall d'Hebron (H4). The eligibility criteria for the centres were as follows: the treatment of at least 50 breast cancer-related lymphoedema cases per year, the systematic use of manual drainage massage and multilayered compression bandages in these patients and a requirement that the physiotherapists had at least two years of experience in the use of

both techniques. The ethics committees of each of the four hospitals had previously approved the project (reference numbers: AC08014, AC-14-078, 2014/5584/I and PR(ATR)193/2014, respectively). All procedures were performed in accordance with the Declaration of Helsinki. Prior to inclusion, patients participating in the study signed a written informed consent form. The trial was registered at ClinicalTrials.gov as ‘Comparison of the Effectiveness of a Precast Adjustable Compression Wrap with the Multilayer Compression Bandage in Upper Limb Lymphedema’ (Identifier: NCT02369679).

Patients with upper limb lymphoedema were selected from the rehabilitation services at the four hospitals. Each patient received the allocated treatment in the outpatient rehabilitation service from which she was recruited. The following inclusion criteria were applied: older than 18 years of age, female, upper limb lymphoedema after axillary lymph node dissection for breast cancer, lymphoedema affecting at least the arm or forearm, a lymphoedema volume excess of 10% or more and the lymphoedema had not been previously treated or had been without treatment for the last 12 months. The exclusion criteria were having bilateral upper limb lymphoedema, cognitive or sensorial impairments that could interfere with collaboration, plexus injury after radiotherapy or disease progression or being pregnant or breastfeeding.

A unique computer-generated balanced randomization list at a ratio of 1:1 was obtained from the research service. Only one researcher received the list and was responsible for the allocation of all the patients at the four hospitals. After obtaining the consent form, the physician in charge of each patient sent an e-mail that included the identification number of the patient to the person responsible for the allocation. The responsible party allocated the treatment consecutively according to the randomization list and sent an e-mail that indicated the allocated treatment to the physician in charge of the patient. The outcome assessors and the statistician in charge of the analysis were blinded to the allocated treatments. The patients, physiotherapists and rehabilitation specialists in charge of the patients were not blinded to the allocated treatment. A

protocol was developed regarding how to collect information, take the measurements and apply the treatments; these aspects were then checked to ensure that all four centres performed the procedures in the same manner.

In the precast adjustable compression system group, the physiotherapist first performed manual lymphatic drainage and then applied the system to the affected upper limb. The Circaid Reduction® was the system used (mediUSA, 6481 Franz Warner Pkwy. Whitsett, NC 27377 800-633-6334). The precast system consists of one-size-fits-all, inelastic, instantly adjustable compression components that are fitted to the patient’s limb size and shape on site. The components are an arm–forearm wrap and a hand wrap up to metacarpophalangeal, which does not include fingers. It is made of a patented, breathable material, adjustable via touch fasteners. Each component consists of a series of offset bands that are wrapped around the arm and fastened with loop closures. It can be readjusted as needed to volume changes of the extremity. The kit includes a card with a colour scale that allows users to achieve the appropriate pressure and the effective compression gradient (Supplemental Figure 1).

In the multilayered compression bandages group, the physiotherapist first performed manual lymphatic drainage and then applied the bandages to the affected upper limb. Both groups were treated by a physiotherapist who was well trained in lymphoedema. Beginning the therapy sessions on Monday was avoided to prevent the 10th session from coinciding with the weekend. Then, the first 10 sessions were performed daily on weekdays. The patients were asked to maintain the precast adjustable compression system or the multilayered compression bandages as set until the next treatment session, even during the weekend (Saturday and Sunday). After the first 10 sessions, the treatment was applied on alternate days (three per week), until the patient received a tailored compression garment (7–14 days).

The skin and lymphoedema conditions were assessed to evaluate adverse effects and the tolerability of the treatments, and the patients were asked about any discomfort or irritation that they felt. The patients also reported how many hours they had

used the precast adjustable compression system or multilayered compression bandages during the treatment period. The physiotherapists recorded all the details of each treatment session on a data collection sheet. The physiotherapists consulted the physician (i.e. a rehabilitation specialist) in the event of any doubts, complications or side effects.

Outcomes were assessed just before the first treatment session, the day after 10 treatment sessions and at the 3-month follow-up exam. The outcome assessors were physicians and physiotherapists who were experts in lymphoedema and were blinded to the allocated treatment. The assessors recorded the weight and height of each patient and measured the perimeters of both upper limbs with an inextensible tape at pre-established points following anatomical landmarks: metacarpophalangeal, ulnar styloid, olecranon, two forearm and two mid-arm points.

A visual analogue scale for each symptom was used in recording the levels of pain, heaviness, tightness and hardness. The scale was a 10-cm-long horizontal line with the limits marked; 0 indicated any presence of the symptom and 10 indicated the maximum intensity of the symptom that could be imagined. Patients were asked to complete each scale with the average of symptoms they perceived in the affected upper limb during the past week.

The physicians recruiting the patients collected the following baseline data: age; body mass index; whether the affected side was dominant or non-dominant and the duration of the lymphoedema. At the 3-month follow-up, the patients reported the number of hours per day that they had used their garments.

The primary outcome was the percentage reduction in the excess volume of the lymphoedema after 10 treatment sessions and at the 3-month follow-up exam. The volumes of both the affected and unaffected upper limbs were obtained using perimeter measurements and the truncated cone formula. The volume of the hand was not included in this outcome since the conical assumption is not valid for the hand shape.¹² The excess volume was the difference between the affected and unaffected limbs, expressed in millilitre. The percentage reduction in the excess volume was obtained as

follows: $((\text{excess volume pretreatment} - \text{excess volume posttreatment}) \times 100 / \text{excess volume pretreatment})$. The secondary outcomes were changes in the visual analogue scale values for pain, heaviness, tightness and hardness at the end of the treatment and at the 3-month follow-up exam.

The sample size calculation was performed considering an effectiveness of the multilayered bandage of 37.2% (SD 17.9%) regarding volume reduction.⁵ A total of 18 individuals were required in each group to detect a difference of 15 units or more, with an $\alpha=0.05$ and a power of 80%. The total sample size was increased to absorb a 30% loss to follow-up.

The analyses were performed using an intention-to-treat approach, in which the patients were analysed according to their allocation. Missing data were handled using the baseline-observation-carried-forward approach. According to their distribution, continuous variables were summarized by the means and standard deviation or median and quartiles, and categorical variables were summarized using *n* values and percentages. Baseline characteristics were compared between groups using an analysis of variance, the Mann-Whitney test or Fisher's exact test, depending on the nature of the variables.

The evolution of each dependent variable was analysed using linear mixed models for repeated measures. An interaction term (time-by-group) was added to assess differences between groups in the evolution of the dependent variables. The interaction time group was presented as the mean difference and 95% confidence interval. All analyses were performed using the SPSS version 12 and STATA 13 software.

Results

Patients were recruited between November 2014 and October 2015, and the follow-up was completed in January 2016. Figure 1 shows the flow diagram with the patient's enrolment and allocation. Of the 48 randomized patients, 42 (89.4%) were analysed (22 in the precast adjustable compression system group and 20 in the multilayered compression bandages group). All four centres treated patients in both groups (Figure 1 and Table 1).

Figure 1. Flow diagram.

Table 1. Baseline characteristics of patients and treatment allocation per hospital.

	All patients (n = 42)	Allocated to PAC (n = 22)	Allocated to MCB (n = 20)	PAC vs MCB (P-value)
Treatment allocation per hospital				0.655
Hospital 1	11 (26.2%)	5 (11.9%)	6 (14.3%)	
Hospital 2	10 (23.8%)	6 (14.3%)	4 (9.5%)	
Hospital 3	11 (26.2%)	7 (16.7%)	4 (9.5%)	
Hospital 4	10 (23.8%)	4 (9.5%)	6 (14.3%)	
Age (years)	59.4 (12.0)	58.6 (12.1)	60.4 (12.1)	0.633
Body mass index (kg/m ²)	28.2 (3.8)	27.9 (3.9)	28.6 (3.7)	0.528
Affected side				0.506
Dominant	20 (47.6%)	10 (23.8%)	10 (23.8%)	
Non-dominant	22 (52.4%)	12 (28.6%)	10 (23.8%)	
Lymphoedema duration (months)	9.3 (3.0–24.2)	7.8 (4.0–24.9)	11.0 (3.0–24.0)	0.801
Lymphoedema severity				0.005
Mild (excess volume < 20%)	14 (33.3%)	12 (28.6%)	2 (4.8%)	
Moderate (excess volume 20%–40%)	15 (35.7%)	4 (9.5%)	11 (26.2%)	
Severe (excess volume > 40%)	13 (31.0%)	6 (14.3%)	7 (16.7%)	
Volume of affected side (mL)	3076.8 (667.4)	3038.6 (740.8)	3118.7 (592.6)	0.703
Volume of contralateral side (mL)	2337.5 (458.7)	2345.4 (538.8)	2328.6 (364.7)	0.906
Excess volume (mL)	739.3 (449.8)	693.0 (534.0)	790.1 (341.0)	0.206
Excess volume (%)	32.3 (20.4)	30.9 (25.4)	33.9 (13.3)	0.626
Pain VAS (mm)	34.5 (28.8)	33.8 (28.0)	35.4 (30.4)	0.871
Heaviness VAS (mm)	41.2 (27.4)	45.1 (25.7)	37.0 (29.2)	0.343
Tightness VAS (mm)	40.8 (29.9)	43.0 (32.4)	37.2 (27.3)	0.529
Hardness VAS (mm)	45.2 (30.0)	45.1 (29.1)	45.3 (31.8)	0.986

PAC, precast adjustable compression; MCB, multilayered compression bandages.

The results are presented as the means and (SD) or in median (quartiles).

Table 1 shows the baseline data for both groups. The all patients' age average was 59.4 (SD 12.0) years; the body mass index average was 28.2 (SD 3.8) kg/m². The median lymphoedema duration was 9.3 (quartiles 3.0–24.2) months and the median of lymphoedema excess of volume was 739.3 (SD 449.8) mL. There were no significant differences between the treatment allocations among the four hospitals. There was a significant between-group difference in the severity of lymphoedema, which was greater in the multilayered compression bandages group. The groups did not differ regarding any of the other baseline characteristics recorded.

The mean of the excess of volume change after 10 sessions of treatment was −131.4 (SD 263.4) mL

in the precast adjustable compression group and −210.1 (SD 146.9) mL in the multilayered compression bandages group. The mean of the excess of volume change at 3 months of follow-up was −133.8 (SD 232.1) mL and −106.2 (SD 148.6) mL, respectively. Table 2 shows the results of the linear mixed-model analysis. Both treatments achieved significant decreases in the excess volume percentage over time, while there were no significant changes when comparing the treatment effect ($\beta=3.04$, $P=0.579$) and the time-treatment effect after the 10th session ($\beta=-2.80$, $P=0.314$) and at 3 months posttreatment ($\beta=2.31$, $P=0.406$). In a similar manner, some symptoms decreased over time; however, there were no significant differences between the treatment and time-treatment effects.

Table 2. Linear mixed-model analysis of outcome measures.

	Regression coefficient β (95% CI)	P-value
Excess volume (%)		
Group (intervention) ^a	3.04 (−7.69 to 13.77)	0.579
Time (T2) ^b	−6.12 (−9.88 to −2.36)	0.001
Time (T3) ^b	−6.07 (−9.83 to −2.31)	0.002
Group (intervention) $\times$ time (T2) ^c	−2.80 (−8.25 to 2.65)	0.314
Group (intervention) $\times$ time (T3) ^c	2.31 (−3.14 to 7.76)	0.406
Pain		
Group (intervention) ^a	1.48 (−14.76 to 17.71)	0.858
Time (T2) ^b	−4.59 (−14.54 to 5.36)	0.366
Time (T3) ^b	−9.77 (−19.72 to 0.18)	0.054
Group (intervention) $\times$ time (T2) ^c	−3.96 (−18.38 to 10.46)	0.591
Group (intervention) $\times$ time (T3) ^c	1.89 (−12.53 to 16.31)	0.798
Heaviness		
Group (intervention) ^a	−8.14 (−24.33 to 8.05)	0.324
Time (T2) ^b	−15.23 (−26.61 to −3.84)	0.009
Time (T3) ^b	−6.37 (−17.75 to 5.02)	0.273
Group (intervention) $\times$ time (T2) ^c	3.03 (−13.47 to 19.52)	0.719
Group (intervention) $\times$ time (T3) ^c	0.11 (−16.38 to 16.61)	0.989
Tightness		
Group (intervention) ^a	−5.90 (−21.80 to 10.01)	0.468
Time (T2) ^b	−12.27 (−23.39 to −1.15)	0.031
Time (T3) ^b	−13.59 (−24.71 to −2.47)	0.273
Group (intervention) $\times$ time (T2) ^c	−10.13 (−26.24 to 5.99)	0.218
Group (intervention) $\times$ time (T3) ^c	0.49 (−15.62 to 16.60)	0.952
Hardness		
Group (intervention) ^a	0.16 (−16.73 to 17.05)	0.985
Time (T2) ^b	−16.45 (−28.70 to −4.21)	0.008
Time (T3) ^b	−14.68 (−26.93 to −2.44)	0.019
Group (intervention) $\times$ time (T2) ^c	−8.65 (−26.40 to 9.10)	0.339
Group (intervention) $\times$ time (T3) ^c	−4.07 (−21.81 to 13.67)	0.653

T1: Baseline; T2: after the 10th session; T3: At 3 months; CI: confidence interval.

^aReference group: precast adjustable compression.

^bReference group: T1.

^cReference group: group (comparison) $\times$ time (T1).

The number of treatment sessions received during the programme was not significantly different between the groups. Patients in the precast adjustable compression system group used the device for a median of 16.2 hours a day, while patients included in the multilayered compression bandages group used the device for a median of 20.6 hours a day, and this difference was significant ($P=0.006$). There were no significant between-group differences

in the number of hours that patients used the garments during the 3-month follow-up (Table 3).

Adverse effects

Regarding adverse effects in the precast adjustable compression system group, one patient had no adverse effects, while other patients experienced the following effects: three patients had paraesthesia;

Table 3. Treatment adherence.

	PAC (<i>n</i> = 22)	MCB (<i>n</i> = 20)	<i>P</i>
	Median (SD)	Mean (SD)	
Number of treatment sessions	13.5 (4.1)	12.6 (3.4)	0.403
Hours per day of PAC or MCB	16.2 (6.5)	20.6 (3.2)	0.006
Hours of garment use during a 3-month follow-up	10.2 (4.0)	11.0 (3.5)	0.847

PAC, precast adjustable compression; MCB, multilayered compression bandages.

one patient had paraesthesia and pain; three patients had pain; three patients had pruritus; three patients withdrew the device at some point due to unspecific discomfort; six patients had skin problems, such as redness, rubbing or abrasion and one patient had mobility problems in their upper extremity while performing their job. All of these adverse effects were managed with simple recommendations, slight adaptations or topical treatment, and none of the patients needed to suspend treatment. One patient's upper limb oedema worsened when she used the precast adjustable compression system. This problem could not be solved after verifying the correct placement and use of the device. Therefore, the application of the precast adjustable compression was suspended after the fourth session, and treatment continued with the multilayered compression bandages daily from fifth to tenth session and three days per week until the patient had the garments. The patient completed treatment without new problems. The measurements of this case were taken as in the rest of patients: previously, at 10th session and at three months.

Effects according to the anatomical area in the precast adjustable compression system group can be summarized as follows: the hands/fingers were affected in seven cases; the volar aspect of the elbow was affected in four cases; the forearm was affected in two cases; the wrist was affected in one case and global or diffuse adverse effects were reported in seven cases.

Regarding adverse effects in the multilayered compression bandages group, six patients had no adverse effects, while the following effects were observed in the other patients: one patient

complained of profuse sweating; one patient reported paraesthesia; three patients mentioned pain; four patients suffered pruritus and five patients had skin problems, such as redness, rubbing or abrasion. One patient was treated with oral gabapentin for neuropathic pain. The remaining patients were managed with simple recommendations, slight adaptations or topical treatment. Treatment was not suspended in any of the cases.

In the multilayered compression bandages group, a summary according to anatomical area is as follows: the hands/fingers were affected in one case; the volar aspect of the elbow was affected in four cases and the adverse effects were global or diffuse in nine cases.

Discussion

In this study, we compared the effectiveness of a precast adjustable compression system to that of multilayered compression bandages, both associated with manual lymphatic drainage, in the decongestive phase of the treatment of upper limb lymphoedema. Both treatments achieved significant decreases in the percentage of excess volume and in the symptoms of pain, heaviness, tightness and hardness. We found no significant differences between the treatments using the same variables of volume and symptoms. This finding implies a new choice in the compression treatment of lymphoedema.

To our knowledge, there have been no clinical trials comparing these two compression systems in upper limb lymphoedema. The only randomized clinical trial that we found, Damstra and Partsch,¹¹

compared a precast adjustable compression system to multilayered compression bandages in the treatment of lower limb lymphoedema. These authors reported a volume reduction of 10% within 24 hours with the precast adjustable compression system, whereas with the multilayered compression bandages, the reduction was 6%, and this difference was significant. Given the methodological differences between the two studies, we cannot compare the results.

The remaining studies that we found on low-elasticity adjustable compression systems were aimed at a heterogeneous target population, particularly for oedema due to chronic venous insufficiency. Mosti et al.⁸ compared the same precast adjustable compression system used in this study to multilayered compression bandages in the decongestive phase of patients with venous oedema of the lower limbs. These authors reported volume reductions within seven days of treatment similar to those found in this study. The differences were significant when both treatments were compared, indicating that the treatment was more effective with the precast adjustable compression system. In a recent review of the use of adjustable compression devices in chronic oedema of the lower limbs, Williams¹³ concluded that the evidence available on their efficacy is limited since the reports are descriptive, non-randomized studies or case series with small samples and short follow-up times.

In this study, a significant reduction in the volume of lymphoedema was observed at three months compared to baseline in both the precast adjustable compression system and multilayered compression bandages groups. These results are similar to those described by Kim et al.¹⁴ after six months of complex decongestive therapy. Nonetheless, other authors have reported a loss of the benefit obtained after treatment. One observational study comparing the use of elastic sleeves with a pressure therapy pump reported that in both treatments, patients returned to baseline volume at 4–12 weeks post-treatment.¹⁵ In a prospective study of patients who underwent decongestive treatment for upper limb lymphoedema after breast cancer, Vignes et al.¹⁶ reported a loss of benefit of more than 10% in half

of the treated patients at six months. The enduring benefit obtained in this study may be related to the use of pressure therapy garments after the decongestive phase.

Some authors have reported improvements in symptoms, such as pain, after decongestive treatment.^{14,17} In this study, the symptomatic improvement persisted in both treatment groups for up to three months.

Most of the adverse effects observed in this study were mild and could be resolved with slight adjustments or skin protection measures, and this result is consistent with the results of Oremus et al.,¹⁵ who reported in a systematic review that the adverse effects of lymphoedema treatments are rare, mild and without relevant clinical repercussions.

However, the precast adjustable compression group had more adverse effects than the multilayered compression bandages group and one of them was severe enough to force the withdrawal of the device. The patient had an increase in the volume of lymphoedema at the beginning of treatment that did not appear when she was treated with multilayered compression bandages. Few studies have reported the adverse effects of lymphoedema treatments. Among them, McNeely et al.⁵ suspended treatment with multilayered compression bandages for two patients due to intolerance. As with any other medical treatment, the appropriate level of tolerance to a precast adjustable compression system or multilayered compression bandages should be monitored in each patient.

Studies involving the precast adjustable compression system applied to the lower limb¹⁸ have suggested cost savings relative to multilayered compression bandages because the adjustable system does not require an experienced professional for daily use and can be applied at home. This aspect has not been addressed in this study and should be confirmed by other studies of the treatment of upper limb lymphoedema.

This study has some limitations that should be noted. The multilayered compression bandages group had a higher percentage of mild lymphoedema than did the precast adjustable compression system group, which implies a bias that could have

influenced the results. In addition, the number of hours of daily use of the compression system during the decongestive phase was significantly lower in the precast adjustable compression system group than in the multilayered compression bandages group. The lack of a no-treatment control group could be a limitation; however, the authors considered that there is much evidence that compression is effective compared with no compression in lymphoedema treatment.¹⁹ This study did not consider the cost-effectiveness or patient acceptability aspects, both of which require further studies. Finally, the results of this study cannot be extrapolated to other types or locations of lymphoedema.

The present results have some potential clinical implications. Precast adjustable compression systems could be used in elderly patients and in patients with osteoarticular or neurological limitations because of the easy application and removal of such a system. Another advantage is that the caregiver or the patient can correct the loss of compression if necessary. Moreover, it could be an effective decongestive system at home if the patient was unable to travel to specialized centres.

In conclusion, there were no significant differences between the effectiveness of a precast adjustable compression system and that of multilayered compression bandages for the treatment of upper limb lymphoedema following breast cancer. The precast adjustable compression system can, therefore, be a useful alternative in the treatment of these patients.

Clinical messages

- In patients with lymphoedema after breast cancer treatment, a standardized precast adjustable compression system is as effective as a multilayered compression bandage and is less difficult to apply.

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Author contributions

V.P.-B. conceived the study, participated in its design and coordination, collected the data, supported the data analysis, interpreted the data and wrote the article. S.S.-H. participated in the study design and coordination, collected the data, supported the data analysis, interpreted the data and wrote the article. M.L.C. conceived the study, participated in its design and coordination, collected the data, supported the data analysis, interpreted the data and wrote the article. T.P. conceived the study, participated in its design and coordination, collected the data, supported the data analysis and interpreted the data. R.B. conceived the study and participated in its design and coordination, collected the data, supported the data analysis and interpretation and wrote the article. All authors have read and approved the final manuscript.

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