




The use of ReadyWrap® reduces the volume of the upper limb with lymphedema related to breast cancer: a case report

Raul Denner Duarte Araújo¹ , Jéssica Malena Pedro da Silva¹ , Suzana Sales de Aguiar¹ , Marcus Vinicius de Mello Pinto² , Luiz Claudio Santos Thuler¹ , Anke Bergmann^{1*} 

ABSTRACT

Lymphedema secondary to breast cancer is a chronic condition that requires continuous care to control the volume of the affected limb, with compression therapy as the main treatment. The self-adjusting compressive wrap is a new option, whose main advantage is the fact that it is put on by the patient himself. The aim of this study was to describe the use of self-adjusting clothing as an alternative to reduce the volume of the upper limb of a patient with breast cancer-related lymphedema. This study was part of the study adjustable garment compression therapy (ReadyWrap®) in lymphedema secondary to breast cancer: a randomized clinical trial, approved by the CEP/INCA under opinion 4.611.711 and registered in the Clinical Trials under no. NCT04934098. The patient was evaluated before and after the 30-day intervention using physical examination (e.g., inspection, palpation, and perimetry). Skin tissue characteristics were collected using a thermographic camera, while the health-related quality of life (HRQoL) was assessed by answering the EORTC-QLQ C30 questionnaire. As an intervention, an adjustable garment (ReadyWrap®) was used for 30 days. An absolute reduction of 612.47 mL (61.1%) was observed, and at the end of this period, the difference of 21.5% in excess volume compared with the volume of the contralateral limb was maintained. Regarding the tissue characteristics of the skin, there was an increase in the minimum temperature in the affected upper limb, which reached 31.8°C, against 31.2°C in the contralateral limb, with $\Delta T=0.6^\circ\text{C}$. Compressive therapy by adjustable garment (ReadyWrap®) demonstrated a 61.1% reduction in the volume of the upper limb with breast cancer-related lymphedema in 30 days of use.

KEYWORDS: breast cancer; breast cancer-related lymphedema; compressive bandages; physiotherapy; case report.

INTRODUCTION

Breast cancer is the most common cancer in women in the world¹. In Brazil, for 2023, 73,610 new cases of the disease were estimated, corresponding to an incidence rate of 41.89 new cases per 100,000 women².

Despite the improvement in access to screening methods for breast cancer, part of the population is still diagnosed with the disease in advanced stages, which requires more aggressive treatments, contributing to the increased incidence of complications³, such as lymphedema, which represents an important public health problem due to its high incidence and chronic condition⁴.

Breast cancer-related lymphedema is the result of the inability to drain the lymphatic system as a result of the surgical approach to axillary lymph nodes and/or postoperative radiotherapy⁵.

Its occurrence may be responsible for physical changes, such as pain, heaviness, and discomfort of the affected upper limb, decreased range of motion, cellulite, as well as psychosocial changes, impacting the quality of life⁶.

Complex decongestive therapy (PDT) remains the gold standard in the treatment of lymphedema. With the objective of reducing the volume of the limb as much as possible, the intensive phase includes skin care, compressive bandaging with multilayer bandages, manual lymphatic drainage, and exercises⁷.

The use of a self-adjusting compression device is a new possibility to treat patients with lymphedema related to breast cancer, demonstrating to be safe, with mild and controlled adverse events, and efficacy similar to compressive therapy with multilayer bandages in reducing the volume of the limb with lymphedema⁸.

¹Instituto Nacional de Câncer – Rio de Janeiro (RJ), Brazil.

²Instituto Celulare – Rio de Janeiro (RJ), Brazil.

Corresponding author: abergmann@inca.gov.br

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Thus, the objective of this case report was to describe how the use of self-adjusting clothing can reduce the volume of the upper limb of a patient with lymphedema.

CASE DESCRIPTION

This report is part of the study “Compressive therapy by self-adjusting clothing (Ready Wrap®) in lymphedema secondary to breast cancer: randomized clinical trial,” approved by CEP/INCA under opinion 4,611,711 and registered in Clinical Trials under No. NCT04934098. The detailed study protocol has been previously published⁹.

A 79-year-old female patient, brown-skinned, widowed, completed higher education, living in the city of Rio de Janeiro/RJ, Brazil, was diagnosed with left-sided breast cancer, micropapillary carcinoma-pT2pN1, G3, underwent segmental breast resection and sentinel lymph node biopsy, and subsequently, adjuvant treatment with chemotherapy, radiotherapy, and hormone therapy.

Following the physiotherapy service, the patient was evaluated on the first day of the postoperative period (1st POD) and by teleconsultation for 30 days. No feeling of heaviness, left upper limb edema (MSE), or surgical wound complications were reported. She had a complete shoulder range of motion and did not report any functional complications.

On physical examination, the volume of the limbs was calculated using the trunk cone formula $V=h*(C^2+Cc+c^2)/(\pi*12)$, where V is the volume of the limb segment, C and c are the circumferences at each end, and h is the distance between the circumferences (C), representing the estimated volume of the limb¹⁰. The percentage reduction in limb volume was calculated by $(VI - VF/VI)*100$, where VI was the initial volume and VF was the final volume. An increase in arm volume greater than 10% in the postoperative period compared with the volume of the arm in the preoperative period is defined as lymphedema¹¹. In the evaluation of the first POD, the patient presented a percentage difference in volume of 2.29%, which was not characterized as lymphedema.

After 26 months of surgery, the patient came to the physiotherapy outpatient clinic reporting swelling and a feeling of heaviness in the upper limb that had started about two months earlier. On physical examination, the volume of the upper limb on the side of the breast cancer was 2,922 mL and that of the contralateral limb was 1,920 mL, corresponding to an excess volume of 52.19%. On palpation, areas of fibrosis were also observed on the forearm.

Skin tissue characteristics and temperature were collected using a FlirOne pro/usb-c thermographic camera. The device has a temperature of -20 to -120°C and 0–400°C, a thermal sensitivity of 150 mK, and an image resolution of 160×120. Regarding the standardization of the collection, all images were taken in a dark room with a thermal scale of 22.0–32.7°C, with respect to the ambient temperature of 23°C.

The patient was instructed to remove her clothes, as well as all accessories, and to wait about 15 min at rest to avoid large temperature variations. The posterior position was chosen for the analysis to standardize the analysis of skin characteristics. The thermal images were analyzed using the comparative method, which consists of investigating things or facts and explaining them according to their similarities and differences¹². Data analysis was performed in a descriptive and diagnostic manner, in order to investigate the cause-and-effect relationship in the object of the study, describing the findings in the calculations (TI (initial temperature) – TF (final temperature) = ΔT (temperature variation)), that is, the difference between the initial and final temperatures of a body¹³.

In the thermographic evaluation, a lack of normal symmetry between the limbs was observed, indicating changes in functional behavior. Bilateral hyporadiation was observed in the triceps brachii and flexor carpi muscles. The temperature recorded in the affected upper limb was 28.2°C and in the contralateral limb was 28.1°C ($\Delta t=0.1^\circ\text{C}$), as shown in Figure 1A and Table 1. After compression therapy, the minimum temperature of the upper limb (T_{min})=31.8°C and of the contralateral limb T_{min} =31.2°C, with $\Delta t=0.5$ (Figure 1B; Table 1).

Health-related quality of life (HRQoL) was assessed using the EORTC QLQ C30 (*European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core 30*), which was validated for use in the Brazilian population¹⁴.

After initial evaluations, the patient underwent lymphedema treatment, including skin care, daily upper limb therapeutic exercises, and the use of compression therapy with a self-adjusting garment (ReadyWrap®) (Figures 2A and 2B). She was instructed to wear the garment all day, especially during the exercises, and at night, to remove it only for bathing.

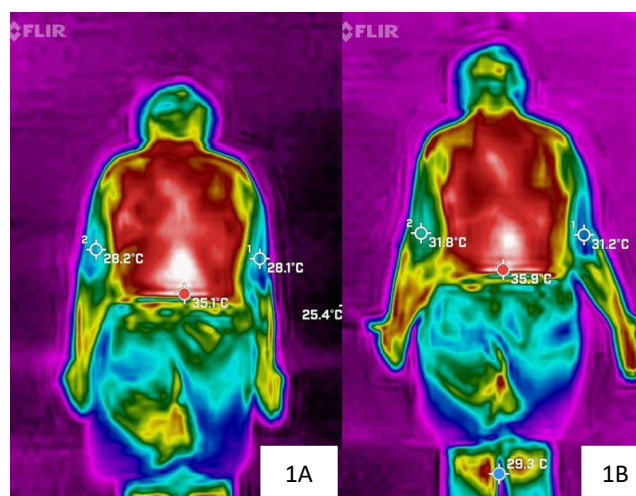


Figure 1. (A) Thermal image with a posterior view (initial evaluation). Point 1 (28.1°C) and point 2 (28.2°C) were selected near the olecranon region. (B) Thermal imaging with a posterior view (after 30 days). Point 1 (31.2°C) and Point 2 (31.8°C) were selected near the olecranon region.

Table 1. Parameters of the evaluations performed before and after 30 days of lymphedema treatment.

| Evaluation | Lymphedema treatment | | |
|--|----------------------|---------------|---------------------------|
| | Initial | After 30 days | Δ Pre- and post-treatment |
| Limb volume | | | |
| ΔV Left upper limb (affected) (mL) | 2922 mL | 2201 mL | -721 mL |
| ΔV Right upper limb (contralateral) (mL) | 1920 mL | 1811 mL | -109 mL |
| ΔV absolute between upper limbs (mL) | 1002 mL | 389 mL | -612 mL |
| ΔV relative between upper limbs (%) | 52.1% | 21.5% | -30.6% |
| Thermography | | | |
| Minimum temperature of the left upper limb (affected) °C | 28.2 | 31.8 | +3.6 |
| Minimum temperature of the right upper limb (contralateral) °C | 28.1 | 31.2 | +3.1 |
| ΔT | 0.1 | 0.6 | +0.5 |
| Quality of life (EORTC QLQ C30) | | | |
| Functional scales* | | | |
| Physical function | 80.0 | 53.3 | 26.7 |
| General function | 66.7 | 50.0 | 16.7 |
| Emotional function | 83.3 | 100.0 | 16.7 |
| Cognitive function | 100.0 | 100.0 | 0 |
| Social function | 66.7 | 100.0 | 33.3 |
| Overall quality of life | 58.3 | 83.3 | 25 |
| Symptom/item scales† | | | |
| Fatigue | 11.1 | 0 | 11.1 |
| Nausea and vomiting | 0 | 0 | 0 |
| Pain | 0 | 0 | 0 |
| Dyspnea | 0 | 0 | 0 |
| Insomnia | 0 | 0 | 0 |
| Lack of appetite | 0 | 0 | 0 |
| Constipation | 0 | 0 | 0 |
| Diarrhea | 0 | 0 | 0 |
| Financial difficulty | 0 | 0 | 0 |

ΔV: volume difference; Δt: temperature difference; EORTC QLQ C30: *European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core 30*. *Higher score is related to a better quality of life; †Higher score is related to a worse quality of life.

These devices are made of wide bands of inelastic material and consist of two pieces (arm and hand), which, adapted to the size and shape of the affected upper limb, extend to the metacarpophalangeal joint. The device is easy to handle—it can be applied and removed by the user himself—as it is closed by velcro straps. This is one of its main advantages, as it allows adjustment as the volume of the affected limb decreases. It also encourages patient autonomy.

Thermography is a safe and non-invasive imaging method that can aid in assessing the distribution of body temperatures. Skin tissue changes, such as inflammation, metabolic changes in the subcutaneous tissue, and blood supply, result in changes in the temperature gradient in the affected area, which can be observed with thermography, as well as the different stages of lymphedema¹⁵.

An absolute reduction of 612.47 mL was observed, corresponding to a relative reduction of 61.13% compared with the

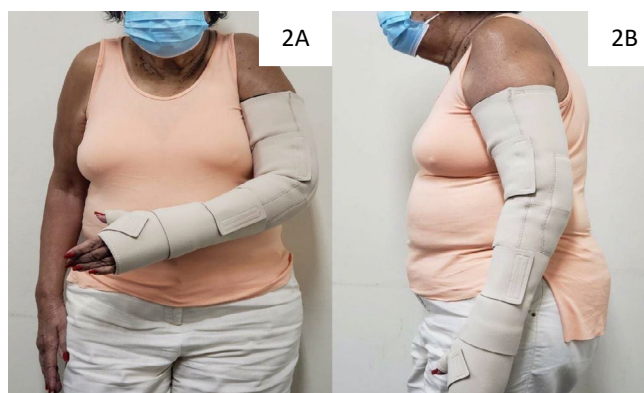


Figure 2. (A) Front image of compression therapy with ReadyWrap® adjustable garment. (B) Side image of compression therapy with ReadyWrap® adjustable garment.

contralateral limb, maintaining a volume difference of 21.52% from one limb to the other (Table 1). Regarding thermography, there was an increase in T_{min} in the affected upper limb of 31.8 and 31.2°C in the contralateral limb, with $\Delta T = 0.6^\circ\text{C}$ (Figure 1B; Table 1).

After 30 days of wearing the garment, the patient showed improvement in general quality of life and the scales of fatigue and emotional and cognitive functions and worsening in physical and general functions (Table 1).

DISCUSSION

In this case report, the use of the self-adjusting compression device (ReadyWrap®) for 30 days proved to be a therapeutic resource capable of helping to reduce the volume of the upper limb in the intensive phase of treatment for lymphedema related to breast cancer.

It can be an alternative in treatment, as clothing therapy can be easily adapted and self-managed, without the need for professional help, unlike conventional therapy with multilayer bandages, in which compressive bandaging is done in an outpatient setting at least twice a week, for approximately 30 days. After the maximum reduction in the volume of the limb, a compressive mesh (standard or custom-made size) is adapted and the patient is instructed on daily home exercises for the upper limbs, in addition to skin care and activities of daily living¹⁶.

To date, we are aware of only one Spanish randomized clinical trial that confirmed that compression therapy with adjustable garments and multilayer compression bandages has similar efficacy in reducing excessive volume or symptoms of upper limb lymphedema in women with breast cancer⁸.

Thermography can be used to evaluate patients with lymphedema, and it is possible to observe hot or cold spots in the affected limb compared with the unaffected limb, such as in women with secondary lymphedema related to breast cancer, in which the

skin temperature tends to be lower, on average 1.3°C, an alteration caused by a decrease in blood flow in the affected limb¹⁷.

To date, there are no studies on the change in limb temperature assessed by thermography during limb volume reduction treatment in patients with cancer-related lymphedema. In this case report, after compression therapy, the patient presented a T_{min} of 31.8°C in the affected upper limb and 38.2°C in the contralateral one, and it was possible to observe $\Delta t = 0.6^\circ\text{C}$, demonstrating an increase in the temperature of the upper limb after treatment with adjustable clothing.

The use of thermography has proven to be a safe assessment method, capable of offering functional information associated with vasodilation, hyperperfusion, and hypoperfusion, measuring various patterns of temperature distribution, and can be a strong ally in the diagnosis of lymphedema¹⁷.

In our study, the patient showed improvement in the functional domains of general quality of life and the scales of fatigue and emotional and cognitive functions after 30 days of PDT using adjustable clothing. In Poland, a randomized clinical trial evaluated the use of low-compression garments in the prevention of lymphedema and its impact on quality of life, demonstrating improvement in the self-reported functional, symptom, and general quality of life scales in the same instrument used in the present questionnaire¹⁸.

On the contrary, physical and social functions presented lower scores, being related to a worse quality of life when evaluated in 30 days, which may lead to speculation, justifying the need to intensify home exercises and the continuous use of compression therapy in the phase of volume reduction of the affected limb¹⁹. This is the most intense moment of lymphedema treatment when limitations in carrying out some daily activities increase and social participation, in general, is reduced.

Compressive therapy by adjustable garment (ReadyWrap®) demonstrated a reduction of more than 50% in the volume of the upper limb with breast cancer-related lymphedema in just 30 days of its use. Self-application of compression can be a facilitator of independence and a sense of control in lymphedema treatment.

This is the first case report to evaluate an adjustable garment in the reduction phase of upper limb lymphedema related to breast cancer in Brazil. Although the results are encouraging, this is a case report, so there are methodological limitations to defining the real impact of this treatment on the alteration of limb volume with lymphedema and on the quality of life of women with lymphedema secondary to breast cancer. Thus, randomized clinical trials are needed to evaluate the efficacy and safety of these devices in this population.

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AUTHORS' CONTRIBUTIONS

RDDA: Formal analysis, Investigation, Writing – original draft. **JMPS:** Formal analysis, Investigation, Writing – original draft. **SSA:** Formal analysis, Data curation, Writing – review & editing. **MVMP:** Conceptualization, Data curation,

Methodology, Resources, Writing – review & editing. **LCST:** Project administration, Supervision, Writing – original draft, Writing – review & editing. **AB:** Project administration, Supervision, Writing – original draft, Writing – review & editing.

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