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Synergistic Effect of low elastic compression sleeves in the treatment of lymphedema after breast cancer treatment

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Abstract

The aim of this study was to evaluate the reduction in volume of lymphedematous arms using an association of low elastic compression and active exercises controlled using a facilitating device. Eighteen female patients with arm lymphedema resulting from the treatment of breast cancer (surgical, chemotherapy and radiotherapy) were randomly included in a rehabilitation group. The mean age of the women was 57.8 years old. The participants were submitted to two one-hour sessions of active exercises, one while using a low elastic compression sleeve and the other without compression. The active exercise session associated with compression therapy significantly reduced the volume of the lymphedematous limb (p-value = 0.001) but no significant change was observed without compression (p-value = 0.6).

Low elastic compression has a synergistic effect with controlled active exercises in reducing the volume of lymphedematous arms.

Key words: compression, exercises, device, synergistic effect

Introduction

Lymphedema is characterized as the abnormal accumulation of protein-rich fluid in the tissues resulting from dysfunction of the lymphatic system causing an imbalance between lymph formation and absorption by the initial lymphatics.

It is one of the diseases that most leads to disability from work in the world, however there are very few clinical studies that guide and support treatment.

It is known that one of the main complications of breast cancer treatment is lymphedema and that this affects hundreds of women throughout Brazil. The World Health Organization estimates that there are more than 1,050,000 new cases of breast cancer worldwide each year, making it the most common type of cancer among women [3].

The estimated number of new cases of breast cancer in Brazil for 2010 is expected to be 49,240 with an estimated risk of 49 cases per 100,000 women. In the southeastern region of the country breast cancer is more common than the national average with an estimated risk of 65 new cases per 100,000 women[4]. A high prevalence of lymphedema has been reported in cancer patients; the rate can be as high as 50% when the patient is submitted to axillary lymph node dissection[5].

An association of therapies, including manual and mechanical lymphatic drainage[6-11], bandaging[12,13], personal hygiene precautions[14], exercising[16,17], myolymphokinetic activities [18,19] and drug therapy[20] is recommended in the treatment of lymphedema. Thus, one area of lymphedema that has been researched very little is what exercises should be indicated in treatment programs. One of the few studies on this issue showed that the lymphoscintigraphic pattern of arm lymphedema improves with exercising [21]. Other studies have shown that a program of moderately intense exercises after the surgical treatment of breast cancer reduce fatigue and improve the quality of life of patients [22,23].

The aim of this study was to evaluate the effect of an association of low elastic compression and controlled active exercises using a facilitating device on edema.

Method

The effect of exercising using a facilitating device on the volume of lymphedematous arms was evaluated both with and without associated compression therapy in a prospective, quantitative study. The participants were enrolled from a lymphedema rehabilitation group in the Godoy Clinic in Sao Jose do Rio Preto-Brazil. Eighteen female patients with unilateral lymphedema resulting from the treatment of breast cancer were randomly selected on a first come basis. The participants' ages ranged from 34 to 78 years old with a mean of 57.8 years. The inclusion criterion was that the lymphedema developed as a result of the surgical treatment, chemotherapy and/or radiotherapy for breast cancer. Those who presented with active infections or severe restrictions in movement were excluded from the study.

The participants were submitted to two one-hour sessions of active exercising on different days while seated with their backs upright. For one session the exercising was associated to the use of a compression sleeve made of a 60-40% cotton-polyester textile called Gorgurão. On the other occasion, no compression mechanism was used. The order of the two sessions, with and without compression was randomized. Each one-hour session consisted of four 12-minute periods of exercising separated by 3-minute breaks to rest.

The active exercising device, similar to a bicycle pedal mechanism, was fixed on a support at a height of 30 cm above the tabletop and at a distance of 10 cm from the patient's body.

Evaluations of the lymphedema before and immediately after each session were performed by volumetry using the water displacement technique. The displaced water was weighed on calibrated digital weighing scales and assessments were made for both normal and lymphedematous arms.

The paired t test was used for statistical analysis with an alpha error of 5% ($p < 0.05$) being considered acceptable. The study was approved by the Research Ethics Committee of the Instituto de Biociências Letras e Ciências Exatas, Campus de Sao Jose do Rio Preto, SP, Brazil (# 11/2007).

Results

Active exercises while using the compression sleeve reduced the volume of the lymphedematous limb by, on average, 85.8 grams (paired t-test - standard deviation 95.8 g; p-value = 0.001), table 1. However there was no significant change when the compression garment was not used (mean difference 7.7 g; p-value = 0.6), table 2.

Table 1: Initial volume and after one hour of exercising using a compression sleeve

Patient	**Lymphedematous arm (with compression)**		
	Initial volume	**Volume after exercising**	**Difference**
1	2191.0	2189.0	- 2.0
2	1847.0	1810.0	- 37.0
3	2501.0	2412.0	- 89.0
4	2234.0	2112.0	- 122.0
5	1857.0	1815.0	- 42.0
6	1711.0	1580.0	- 131.0
7	1760.0	1747.0	- 13.0
8	2568.0	2551.0	- 17.0
9	1711.0	1654.0	- 57.0
10	1811.0	1738.0	- 73.0
11	1867.0	1738.0	- 129.0
12	2019.0	1951.0	- 68.0
13	2191.0	2054.0	- 137.0
14	1847.0	1761.0	- 86.0
15	1782.0	1709.0	- 73.0
16	2002.0	1976.0	- 26.0
17	1863.0	1771.0	- 92.0
18	2148.0	2096.0	- 52.0

Table 2: Initial volume and after one hour of exercising without any compression mechanism

Patient	Lymphedematous arm (without compression)		
	Initial volume	**Volume after exercising**	**Difference**
1	2378.0	2336.0	-42.0
2	1923.0	1960.0	+ 37.0
3	2108.0	2076.0	- 32
4	2558.0	2588.0	+ 30.0
5	2014.0	2095.0	+ 81.0
6	1603.0	1644.0	+ 41.0
7	2238.0	2296.0	+ 58.0
8	1731.0	1776.0	+ 45.0
9	1750.0	1790.0	+ 40.0
10	2596.0	2604.0	+ 8.0
11	2791.0	2891.0	+ 100.0
12	1863.0	1787.0	- 76.0
13	1847.0	1788.0	-59.0
14	1718.0	1740.0	+ 38.0
15	3034.0	2982.0	- 52.0
16	1857.0	1863.0	+ 6.0
17	1714.0	1795.0	+ 81.0
18	2002.0	2113.0	+ 111.0

Discussion

This study shows that the volume of lymphedematous arms is reduced immediately at the end of controlled exercising sessions using low elastic compression. The low elastic compression sleeve used in this study was tailor made of a cotton-polyester fabric for each patient. A study that evaluated this textile showed that it exerts great variations in working pressure during exercising and thus it causes differential pressures at the interface between the compression garment and the skin [24].

Studies have assessed the association of this compression mechanism over one month and showed that, with muscle activity, the volume of the limb was reduced thereby proving the efficacy of this type of treatment [13,18]. Other types of programmed exercises associated with compression have also been evaluated and have proven to be effective in reducing limb volume [11,13,17,18]. This shows that there is a synergistic effect combining compression therapy with muscle activities, including those of programmed exercising sessions, in respect to reductions in the volume of lymphedema.

The effect of gravitational pressure is crucial in the therapeutic management of lymphedema, especially on the lower limbs [25]. Additionally, adjustments to the compression garment are essential to ensure success in treatment; a badly adjusted garment does not exert pressure or can even aggravate the edema by acting as a tourniquet around the limb.

This form of compression can be used instead of inelastic bandages thereby giving significantly more independence to patients who are able to dress and undress the compression garment by themselves. Adaptation of daily activities with the use of this compression mechanism seems to be the most appropriate manner to treat lymphedema. Performing controlled exercises is not always practical because patients often have many things to do during the day. Thus, adapting daily activities is a new perspective in the treatment of lymphedema.

The low cost and possibility of making this compression garment anywhere will make life easier for patients. Another aspect is the constant adjustment which represents a reduction in volume, that is, the effectiveness of this therapy; as the compression garment is not elastic, the size must be regulated constantly for treatment to be efficacious.

Conclusion

Low elastic compression sleeves have a synergistic effect with controlled exercising to reduce the volume of lymphedematous limbs.

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