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Pilot study to evaluate an apparatus for mechanical lymph drainage

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Abstract

Introduction. *An association of therapies is recommended in the treatment of lymphedema with lymph drainage constituting one of the most important.*

Material and methods. *The aim of this study was to evaluate a 3-hour session of a new mechanical lymph drainage method utilizing the RAGodoy® apparatus. Volumetry was used to assess passive exercising in 13 patients suffering from arm lymphedema after breast cancer treatment. The participants' age varied between 42 and 78 years old. Patients were submitted to mechanical lymph drainage using a passive, electromechanical apparatus for the upper limbs denominated RAGodoy®. This apparatus performs bending and stretching exercises of the elbow. Measurements by water displacement volumetry were taken at the start and at hourly intervals during the 3-hour session. The paired t-test was used for statistical analysis, with an alpha error of 5% being considered acceptable.*

Results. *The greatest reduction was observed in the first hour (p-value = 0.0001) with increases in volume being seen after the second and third hour compared to the end of the first hour (p-value = 0.001).*

Conclusion. *Mechanical lymph drainage utilizing the RAGodoy® apparatus is efficient to reduce the volume of lymphedematous arms, however its use is not recommended for more than one hour.*

Key words: lymphedema, treatment, upper extremity

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Introduction

Lymphedema is characterized by an abnormal accumulation of fluids and other substances in the tissues due to a failure of the lymphatic system [1, 2].

An association of therapies is recommended to treat lymphedema that include manual and mechanical lymph drainage, myolymphokinetic exercises, compression garments and bandages, hygienic care and care during day-to-day life, psychological support and lymphokinetic drugs [2].

Exercising, associated with compression mechanisms and lymph drainage, is one of the three cornerstones in the treatment of lymphedema [3, 4]. However, there are few studies evaluating mechanical lymph drainage of the upper limbs [5, 6].

The aim of this study was to evaluate a new method of mechanical lymph drainage over a three-hour session using the RAGodoy® apparatus.

Material and methods

Thirteen patients with breast cancer treatment-related arm lymphedema aged 42–76 years old (average — 56.7) were randomly selected. All patients underwent mastectomy with axillary dissection, but without

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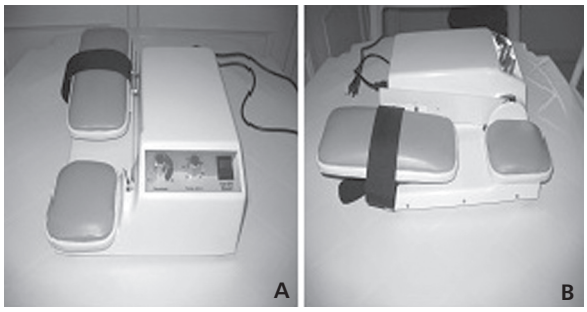

Figure 1A, B. The RAGodoy® apparatus

evidence of tumor activity at the time of the study. The inclusion criterion was the presence of lymphedema and exclusion was limitation of joint mobility and infection. Lymphedema was defined as a difference in volume of more than 200 ml between arms. Patients were subjected to mechanical lymph drainage using an electromechanical device (RAGodoy®, São Jose do Rio Preto, Brazil), to perform passive movements with flexion and extension of the elbow (fig. 1A, B). Mechanical lymph drainage was performed for three hours and water displacement volumetry using calibrated digital scales was performed to evaluate the size of the lymphedematous arm before the start of the session and at hourly intervals. Neither compression mechanisms nor any other associated treatment was used in this study.

The paired t-test was used for statistical analysis with an alpha error of 5% being considered acceptable. The study was approved by the Research Ethics Committee of the Medicine School in São José do Rio Preto (237/2004).

Results

Volume was lost in the first hour; during the second and third hour there were increases in volume when compared to the first hour. The mean decrease was significant at the end of the first hour (p-value = 0.000) and at the end of three hours (p-value = 0.014) compared to the initial values. Table 1 shows the volumes before the start of the session and then at hourly intervals. No statistical difference was seen between the second and third hour (Bonferroni alpha correction = 0.008; p-value = 0.01; tab. 2).

Table 1. Volume of the arm before starting mechanical lymph drainage using the RAGodoy® apparatus and at the end of the first, second and third hour

Patient	Initial volume of the arm (ml)	Volume at the end of 1st hour (ml)	Volume at the end of 2nd hour (ml)	Volume at the end of 3rd hour (ml)	Difference between the initial and final volumes (ml)
1	2291	2210	2242	2202	-89
2	1439	1376	1423	1426	-13
3	1698	1532	1536	1619	-79
4	1917	1864	1903	1932	15
5	1993	1896	2009	1998	5
6	1552	1487	1476	1483	-69
7	2649	2536	2561	2596	-53
8	2236	2179	2064	2096	-140
9	2843	2735	2692	2714	-129
10	1657	1562	1598	1662	5
11	1342	1268	1267	1425	83
12	2680	2647	2701	2560	-120
13	2166	2086	2078	2040	-126

Table 2. Statistical analysis of the variations in the arm volume obtained with mechanical lymph drainage employing the RAGodoy® apparatus after applying t-test with a Bonferroni alpha correction of 0.008

Period (hours)	n	Mean	SD	SE	95% CI	T	p-value
0–1	13	83.46	33.72	9.35	(63.08; 103.84)	8.92	0.000*
0–2	13	70.2	63.5	17.6	(31.8; 108.6)	3.99	0.002
0–3	13	54.6	68.8	19.1	(13.0; 96.2)	2.86	0.014

SD — standard deviation, SE — standard error, CI — confidence interval

Conclusion

This study evaluated the use of mechanical lymph drainage using passive flexion and extension movements of the arm to treat lymphedema. A previous pilot study showed that its use reduces the volume of the arm [6], however the objective of this study was to evaluate its continuous intensive use. The results do not suggest that its continuous use for more than one hour is beneficial to the treatment of lymphedema.

An intensive approach using mechanical lymph drainage for 6 to 8 hours per day has been evaluated to treat lymphedema of the lower limbs; this showed that there is a continued reduction of the leg lymphedema during all the treatment session [7, 8]. In an ongoing study, the synergistic effect of the use of a compression mechanism with mechanical drainage is being evaluated with promising preliminary results. However, for arm lymphedema, the continuous use of mechanical lymph drainage for more than one hour is not recommended, however by associating this with manual lymph drainage and compression a continuous reduction can be achieved.

During this study patients reported tiredness after one hour of exercising, perhaps due to sitting for a long time. However, patients have also reported becoming tired while exercising, lying on an exercise mat. These observations are important because they help to define the best way to use the mechanical lymph drainage device. One idea is to have breaks during exercising; this is possible with an intensive association of therapies (active and passive exercises, manual lymph drainage, and compression mechanisms).

Lymphedema of the arms causes a series of complications such as tendonitis and limitations in joint mobility. Therefore, intensive lymphedema treatment should be considered and proposed to these patients. Manual lymph drainage both in isolation and as part of intensive treatment enables rapid reduction in the volume of limbs but becomes very tiring for both the professional and patient. In this way, an association of therapies is an alternative to be considered.

Conclusion

Mechanical lymph drainage of the upper limbs using the RAGodoy® apparatus is more effective in reducing volume during the first hour than in subsequent hours and thus it is not recommended to perform mechanical lymph drainage continuously for periods of more than one hour.

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