

Interference of gravitational pressure during active exercising of patients with lymphedema of the lower limbs

José Maria Pereira de Godoy, MD, PhD*¹ Maria de Fátima Guerreiro Godoy, OT, PhD² Flávia Mariana Valente, PhT³

Adress: ¹ Cardiology and Cardiovascular Surgery Department in Medicine School in São José do Rio Preto (FAMERP)-Brazil ² Medicine School of São Jose do Rio Preto-(FAMERP) and Godoy Clinic ³ Godoy Clinic- Avenida Constituição,1306 São Jose do Rio Preto-SP-Brazil Zip code: 15025-120

E-mail: José Maria Pereira de Godoy: godoyjmp@riopreto.com.br *corresponding author

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Abstract

The adaptive mechanisms that prevent edema of the lower limbs when standing involve the action of muscles pumping fluids against the force of gravity. The objective of the current study was to evaluate the interference of gravitational pressure on active exercises of lower limbs with lymphedema. A total of 24 male and 5 female patients with a mean age of 34.6 and lymphedema of the lower limbs were evaluated. Volumetric evaluations were made before and after one hour performing three different activities utilizing the displacement of water technique similar to the method used by the ancient Greeks. Three different activities were utilized: 1) one hour laid down at rest with the affected limb on a sofa; 2) one hour with the limb supported on a sofa performing plantar bending and stretching exercises at about 20 to 30 movements per hour controlled by an observer and 3) one hour laid on a mattress performing plantar bending and stretching exercises at about 20 to 30 movements per hour also controlled by an observer. The student t-test was employed for statistical analysis with an alpha error of 5% considered acceptable. The greatest volume losses were experienced by individuals exercising with the limbs supported on a sofa which when compared to the lowest reductions for exercises performed on a mattress gave a p-value = 0.023. There was no significant difference between resting on the sofa and exercising on a mattress (p-value = 0.59).

Introduction

The adaptive mechanisms that prevent edema of the lower limbs when standing involve the action of muscles pumping fluids against the force of gravity, pre-capillary vasoconstriction, low permeability of the capillaries for plasmatic proteins and tissue and blood pressures responsible for transcapillary exchange 1.

Physical exercise makes maintenance of homeostasis a challenge for control systems of the body 2 with activities of the calf muscles being the main anatomic structure responsible for venous pressure drops in the lower limbs 3.

Redirecting the blood flow to active muscle groups does not result in an excessive accumulation of blood in the lower limbs when standing except in cases of venous hypertension 4. A healthy organism thus maintains adequate venous return, capable of not impairing the increased heart outflow during physical exercise 2,3. One of the foundations in the treatment of lymphedema is exercising nevertheless there are few published studies

on this subject in the Pubmed, ISI, Scopus and Lilacs databases.

The objective of the current study was to evaluate the interference of gravitational pressure on active exercises of lower limbs with lymphedema.

Methods

Patients with lymphedema of the lower limbs as identified by clinical and lymphoscintigraphic diagnoses were evaluated. A total of 24 male and 5 female patients with a mean age of 34.6 years old were included in the study. Volumetric evaluations were made before and after one hour of three different activities utilizing the displacement of water technique similar to the method used by the ancient Greeks. The three different activities were: 1) one hour laid down at rest with the affected limb supported on a sofa ; 2) one hour with the limbs supported on a sofa performing plantar bending and stretching exercises at about 20 to 30 movements per hour controlled by an observer and 3) one hour of plantar bending and stretching exercises on a 20cm-

thick mattress at about 20 to 30 movements per hour also controlled by an observer. The exercises were performed on different days during the same week with a lottery soon after realizing the volumetry. The last exercise was performed by individuals not chosen by the lottery. The student t-test was employed for statistical analysis with an alpha error of 5% considered acceptable.

Results

The greatest volume losses were experienced by individuals exercising with the affected limb supported on a sofa which, when compared to the lowest reductions for exercises performed on a mattress, gave a p-value 0.023. There was no significant difference between resting on the sofa and exercising on the mattress (p-value = 0.59).

Table 1 – The differences in volumes after exercising on a sofa, exercising of a mattress and resting on a sofa

	Exercising a mattress	Exercising a sofa	Resting a sofa
Mean volume losses (ml)	-64.414	-98.125	-72.192
Nº of limbs	29	29	29

Discussion

The current study shows that with active exercises of lower limbs with lymphedema, gravitational pressure exerts a negative effect in respect to reduction in volume. Thus, raising the limb constitutes a synergic artifice during exercising for these patients. In this study, just placing the limb on the sofa is sufficient to reduce the edema. It is important to note that exercising with the effect of gravity gave a numeric reduction of only 64.41 mL against 72.1 mL during resting without gravitational pressure (elevation of the limb on the sofa). In a number of pilot studies performed by the authors, it was observed that the intensity of the exerted force may interfere in the reduction of volume and even, occasionally, the volume may increase. The quantity of capillary filtration may be greater than the drainage capacity of the venous and lymphatic systems, leading to an increase in the size of the limb. There are different responses for each patient, thus the intensity of each activity should be individually evaluated.

Volumetry is the gold standard and also a cheap test to assess these variations, and so should be routinely used for the evaluation of the activities recommended for patients suffering from lymphedema.

Other possibility in treatment of venous and lymphatic disease is association during exercises compression mechanism 5. Compression is a physical force that,

applied on the skin, using either elastic or non-elastic materials, exerts a pressure on the tissues of the body and on the macro- and microcirculation systems, thereby diminishing the edema and improving the functioning of the limb 6,7. These activities constitute important forms of lymphedema treatment, but guidance and evaluation of patients are required. The authors recommend that each patient is assessed individually for each of the exercises proposed. There are few studies in the Pubmed, ISI, Scopus database evaluating exercising of the lower limbs of patients with lymphedema, even though this is one of the cornerstones in the treatment of this disease.

Conclusion

Gravity negatively affects the reduction in size during exercising of patients suffering from lymphedema of the lower limbs.

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