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Research paper

Effects of microcurrents and physical exercise on the abdominal fat in patients with coronary artery disease

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ABSTRACT

Introduction: Coronary artery disease is associated with decreased levels of physical activity, contributing to increases in abdominal fat and consequently increasing metabolic risk. The innovative use of microcurrents may be an effective method to increase the lipolytic rate of abdominal adipocytes. This study aimed to investigate the effects of utilizing microcurrents in a home-based exercise program in subjects with coronary artery disease to assess changes in total, subcutaneous and visceral abdominal adipose tissue.
Methods: This controlled trial included 44 subjects with myocardial infarction, randomly divided into Intervention Group 1 (IG1; $n = 16$), Intervention Group 2 (IG2; $n = 12$) and Control Group (CG; $n = 16$). IG1 performed a specific exercise program at home during 8 weeks, and IG2 additionally used microcurrents on the abdominal region before the exercise program. All groups were given health education sessions. Computed tomography was used to evaluate abdominal, subcutaneous and visceral fat, accelerometers to measure habitual physical activity and the semi-quantitative food frequency questionnaire for dietary intake.
Results: After 8 weeks, IG2 showed a significantly decrease in subcutaneous fat ($p \leq 0.05$) when compared to CG. Concerning visceral fat, both intervention groups showed a significant decrease in comparison to the CG ($p \leq 0.05$). No significant changes were found between groups on dietary intake and habitual physical activity, except for sedentary activity that decreased significantly for IG2 in comparison with CG ($p \leq 0.05$).
Conclusion: This specific home-based exercise program using microcurrent therapy for individuals with coronary artery disease showed improvements in visceral and subcutaneous abdominal fat.

1. Introduction

Cardiovascular diseases (CVD) are considered to be the primary cause of death worldwide [1]. World Health Organization predicts more than 23.3 million deaths per year from CVD by 2030 [1].

Cardiovascular rehabilitation (CR) programs involve specific components such as education, counseling, behavior changes and physical exercise, in order to stimulate an active lifestyle and decrease cardiovascular risks [2,3]. Implementing home-based programs seems to improve adherence by overcoming some of the causes for their underuse [4,5].

A sedentary lifestyle associated with inappropriate food intake and has an impact on energetic balance contributing to overweight [6,7].

The larger number of fat cells in the abdominal region increases metabolic complications [8,9]. This association seems to be due to a higher lipolytic rate in the visceral and deep subcutaneous adipose tissue, promoting an increase of free fatty acids (FA) in the blood circulation [10–12], and an increase in the hepatic synthesis of triglycerides, which translates into dyslipidemia [13]. Additionally, the adipose tissue plays an important role in the development of a systemic inflammatory state, by secreting several cytokines and chemokines [14,15]. This makes abdominal obesity a therapeutic target for CVD's patients.

Electrolipolysis techniques, using low frequency microcurrents and microamperes, are an innovative and effective method to help

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the lipolysis in a localized abdominal adipose tissue. The lipolysis effect by microcurrent is explained by an increase of adenosine triphosphate—ATP production, amino acid transport, and protein synthesis [16–18] which promotes an increase of catecholamines' concentration, and consequently the activation of triglyceride lipase and hormone-sensitive lipase enzymes [19]. In addition, a thermal effect increases the blood flow and metabolism changes in membrane polarity, causing an increase of organelles' numbers responsible for cellular activities [16].

After triglyceride lipolysis into FA and glycerol, FA combines with albumin to create a free FA that can be used as energy source during physical exercise [13,20].

The application of this new electrolytic tool in conjunction with home-based exercise program aims to interfere directly in some cardiovascular risk factors, such as physical inactivity and obesity with android pattern. Such combination may promote greater health gains, minimizing the cardiovascular risks, in these populations [6,7,21]. In this sense, the present study aims to investigate the effects of microcurrents and a home-based exercise program on total, subcutaneous and visceral abdominal adipose tissue in patients with coronary artery disease.

2. Methods

2.1. Study design, randomization, and implementation

This is a pilot and feasibility study investigating in a single center, and using a parallel-group, randomized controlled trial over 16 months. The participants, subjects with known coronary artery disease after one year of hospitalization for acute myocardial infarction (MI), were recruited at the cardiology outpatient service of a central hospital.

The study design is depicted in Fig. 1. Briefly, patients were invited to participate in the study and come to the cardiology outpatient service twice: once at the beginning of the study, initial moment (M0); and 2 months later, final moment (M1). At M0, participants were randomly assigned to one of three groups: Intervention Group 1 (IG1), which performed a specific exercise program at home; Intervention Group 2 (IG2) which underwent microcurrent application and the exercise program; and the Control Group (CG), which received usual medical care and follow-up. A randomization by blocks was used, and an allocation sequence based on a fixed block size of 3 was generated with a computer random number generator by an investigator not involved in the trial. All groups were provided with education sessions about Mediterranean diet and smoking cessation. At M0 and M1 each participant underwent several evaluations in the

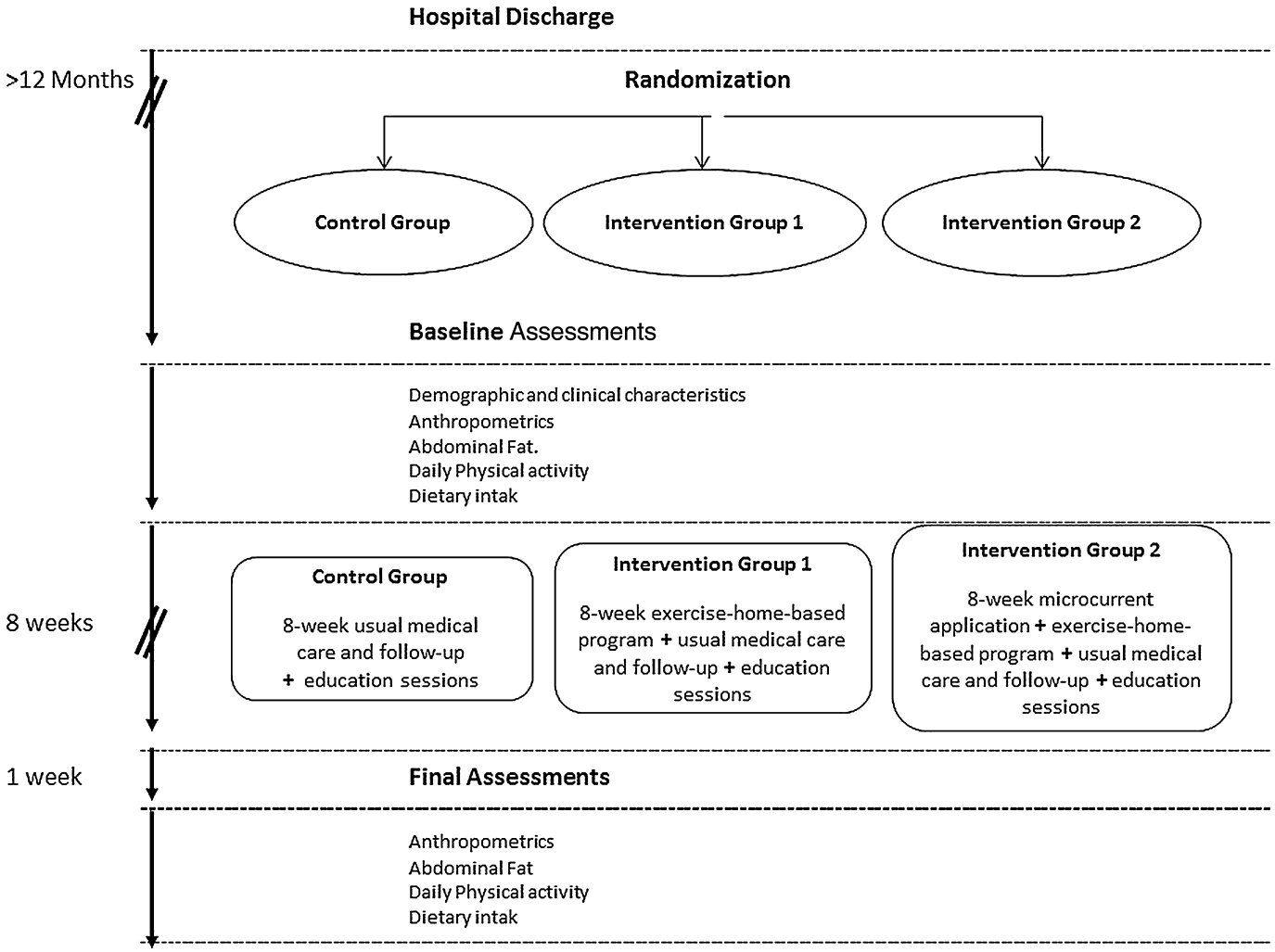

Fig. 1. Study design (figure hospital discharge).