PILATES PRINCIPLES IN LUNG FUNCTION IN PATIENTS IN CARDIAC SURGERY POSTOPERATIVE

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ABSTRACT

Whereas cardiac surgery can result in pulmonary dysfunction and it becomes necessary indication of respiratory therapy to prevent the development of pulmonary complications. Pilates is considered a method to promote rebalancing of lung function. The objective was to evaluate the applicability of the Pilates principles in Respiratory Muscle Training in patients after cardiac surgery. A prospective, controlled and randomized clinical trial a was conducted. The survey was conducted in the Hospitalization Unit of the Nobre Cardiology Institute (INCARDIO). The sample comprised 14 patients. Patients were divided randomly into two groups: intervention group and control group. In the intervention group, patients underwent a respiratory muscle training program using the principles of Pilates. In the control group, patients underwent conventional respiratory muscle training unit. Comparing the data from the initial and final evaluations of respiratory muscle strength (MIP e MEP), there was no statistical difference with a $p = 0.45$ and $p = 0.40$, respectively. However, comparing data on initial and final vital capacity (31.2 ± 3.8 and 43.4 ± 12.7), it was observed that the intervention group Pilates showed an improvement on this parameter, with statistical significance ($p < 0.001$). The respiratory muscle training using the Pilates method is ineffective to gain muscle strength, but there was a significant effect on vital capacity, being a viable practice to improve the ventilation in this patient profile.

KEYWORDS: Thoracic Surgery, respiratory function tests, breathing exercises, physical therapy.

1. INTRODUCTION

Cardiac surgery can result in a presentation of pulmonary dysfunction. Muscle training in general aims at an increase in muscle strength, hypertrophy and/ or endurance of the muscle fibers[1]. One of the features that be used as proposed in promoting muscle rebalance is Pilates method, which consists of a series of physical exercises, seeking harmony between the body and the mind. Pilates is a physical and mental training, which improves body awareness to work the body as a whole. This method has gained popularity in recent years, being used for fitness and rehabilitation programs.

The Pilates principles can promote cardiorespiratory fitness. The benefits of the method only depend on the performance of the exercises faithfully to its principles, breathing being the most important principle[2].

In Pilates, all exercises are associated with breathing. Joseph Pilates emphasized the breath as the primary factor where the inspiration takes place to prepare for the move and the expiration occurs while performing it[3-6]. carry out the Pilates method, several muscles are activated, including the muscles involved in breathing, especially the expiratory muscles, which remain contracted during the inspiratory and expiratory phase. As a result this contraction, to perform the inspiration, the (inspiratory muscle main), need to perform a greater contraction force, to perform the lowering of its dome[7].

The breathing pattern of the method is considered a therapy because it seeks to reduce its pace and increase depth[8]. Unlike other forms of physical training, Pilates does not favor hypertrophy, but the muscle balance, so that the muscle groups interact with strength and flexibility, improved coordination of breathing and intense strengthening the abdominal muscles and other muscles inserted in trunk[9].

Given the growth of Pilates practice and knowing the benefits of this, in relation to functional performance, including the respiratory system, is necessary to observe the application of the Pilates principles in hospitals. Therefore, this study aimed to develop and evaluate a Muscular Respiratory Training Program using the Pilates principles.

2. MATERIAL AND MÉTHODS

This study was characterized as a prospective, controlled and randomized clinical trial.

The research included 14 volunteer patients, whose selection was intentional, admitted to the Cardiology

Institute Nobre (INCARDIO) from Feira de Santana, Bahia, Brazil, which signed the Consent and Informed (IC), allowing participation in this study, parallel the physiotherapy treatment.

The criteria for inclusion of patients in the study were: individuals of both genders, aged above 18 years and undergoing heart surgery procedure (CABG, aortic and/ or mitral valves replacement, atrial septal defect correction). The study excluded patients with hemodynamic instability, prior heart surgery, or previous history of lung disease symptoms, difficult to understand or perform the measures or physiotherapeutic conducts and refusal to participate in the study.

The patients underwent two evaluations: clinical and respiratory function. In clinical evaluation, we collected anthropometric data and the clinical history. The evaluation of respiratory function, evaluated the lung function by measuring the spirometric variable Forced Vital Capacity (FVC) and respiratory muscle strength with the measures of Maximum inspiratory pressure (MIP) and Maximum Expiratory Pressure (MEP) through the analog mono vacuum meter. These variables were measured at 1st and 5th days at the beginning and after the exercises.

Patients were divided randomly into two groups: Intervention Group and Control Group. The groups were managed according to routine inpatient unit of the Cardiology Institute Nobre. In the Intervention Group, patients underwent a respiratory muscle training program using the principles of Pilates for 5 days a week, two times a day (morning/ afternoon), totaling 10 sessions. In the Control Group, patients underwent routine physical therapy of the institution, without doing extra treatment.

Data analysis was performed by numerical comparisons and statistical inferences. Data collected for analysis were compared with the before and after application of the Pilates principles on lung function, undergoing testing and validating hypotheses with statistical probability.

This study was developed according to Resolution No. 466/12 of CONEP - National Research Ethics Commission approving the guidelines and regulatory standards for research involving human beings, and started after approval by the Ethics Committee of the Faculty Nobre (FAN) from Feira de Santana, Bahia, Brazil.

3. RESULTS

From 18 September to 28 October 2014 were evaluated 23 patients. Of these, 6 were excluded because they had complications during the postoperative period to return to the ICU (Intensive Care Unit), 2 refused to perform the exercises and there was 1 death occurred.
The final sample consisted of 14 individuals, divided into two groups. The control group consisted of 7 patients, 5 men (71.4%) and 2 women (28.6%) with a mean age of 53.1 ± 10.7 years. The intervention group included 7 patients, 4 men (57.1%) and 3 women (42.9%) with mean age of 40.1 ± 18.2 (Table 1).

Table 1. Demographic and anthropometric characteristics of the sample, Feira de Santana, BA, Brazil, (2014).

Feature	Control Group	Group Intervention
N°. of participants	7	7
Male (n)	5	4
Female (n)	2	3
Age (years), mean ± SD	53.1 ± 10.7	40.1 ± 18.2

It was announced that among the 14 patients evaluated 8 individuals passed through the surgical procedure from coronary artery bypass graft, totaling 57.1% of the sample, five individuals did mitral valve, totaling 35.7% of the sample and did 1indivíduo aortic valve, totaling 7.2% of the sample (Table 2).

Table 2. Characteristics of the sample in relation to the type of surgical procedure, Feira de Santana, BA, Brazil, (2014).

Type surgery (n) %	Control Group	Group Intervention
Myocardial revascularization	5 (71.4)	3 (42.9)
Aortic valve replacement	0 (0.0)	1 (14.2)

Regarding the MIP, MEP and Vital Capacity (VC), the control group came from mean values of respectively 31.4 ± 10.6 cmH_20, 37.1 ± 18.8 and 20.2 ± 4.5 cmH_20 mL/ kg and at the end of the study had an MIP, MEP and CV respectively, 64 ± 19.8 cmH_20, 54.5 ± 24.5 and 31.2 ± 3.8 cmH_20 mL/ kg. Longer the intervention group at the beginning had a MIP, MEP and CV, respectively, 46.2 ± 14.9 cmH_20, 35.4 ± 11.1 and 28.1 ± 9.6 cmH_20. At the end of the study the intervention group had an average of MIP, MEP and CV respectively, 53.4 ± 20.8 cmH_20, 54 ± 11.9 cmH_2O and 43.4 ± 12.7 mL/ kg (Table 3).

Table 3. Spirometric variables, spirometry and statistical analysis, Feira de Santana, BA, Brazil, (2014).

Variables	Control Group	Group Intervention	*p*
MIP initial	31.4 ± 10.6	46.2 ± 14.9	0.38
MIP final	64 ± 19.8	53.4 ± 20.8	0.45
MEP initial	37.1 ± 18.8	35.4 ± 11.1	0.90
MEP final	64.5 ± 24.5	54 ± 11.9	0.40
VC initial	20.2 ± 4.5	28.1 ± 9.6	0.34
VC final	31.2 ± 3.8	43.4 ± 12.7	0.001

MIP: Maximum inspiratory pressure; MEP: maximal expiratory pressure; VC: Vital Capacity

Comparing the data from the initial and final evaluations of respiratory muscle strength (MIP and MEP), there was no statistical difference (p = 0.45 and p = 0.40,

respectively). However, comparing data on initial and final vital capacity (31.2 ± 3.8 and 43.4 ± 12.7), it was observed that the intervention group Pilates showed an improvement on this parameter, with statistical significance ($p < 0.001$).

4. DISCUSSION

Giacomazzi *et al.* (2006)[10] studied 30 subjects aged 53.9 ± 13.93 years (mean ± SD) of both genders, with 73.3% male, who underwent bypass surgery infarction (50%), valve replacement (49%) and partial valve resection (1%). Similar data were found in our study, where there was a prevalence of males and the most frequent type of surgery was coronary artery bypass grafting.

On the longitudinal and descriptive study in preoperative and postoperative evaluation chips conducted by Gonçalves *et al.* (2012)[11] in order to determine the prevalence of types of heart surgery and the relationship with age and gender in the cardiac rehabilitation service in a university hospital from Santa Maria, a male predominance was evident (66.9%) in the surgeries, and in relation to age variable there was no difference between genders.

Brick *et al.* (2004)[12] explain that one of the most frequent heart surgery performed over the past decades is coronary artery bypass grafting, where they can be associated with other cardiac surgery. Advances related to technology and surgical technique has occurred since the completion of the first direct coronary artery bypass grafting.

In the present study, there was an increase in MIP and MEP values in the intervention group, comparing the values obtained at the beginning and end of the training with the Pilates method. However, compared to the values found in the control group, no significant difference. Different results were obtained by Andrade (2010)[13], where the MIP and the MEP were significantly higher in the intervention group compared to the control group, evaluating women who practice Pilates for at least three months and sedentary women, respectively. Lopes *et al.* (2014)[14], when assessing the effects from Pilates exercises on respiratory muscle strength in older, also found a significant increase in MIP and MEP values after 11 weeks of training.

The profile of the patients in our study differed from previous studies because it is a sample of patients in the postoperative period of cardiac surgery, which are more susceptible to lung disorders and a slower gain of respiratory muscle strength compared to the profile of patients[13,14].

In our study, we found the existence of a reduced vital capacity at the first trial and this for Guizilini *et al.* (2004)[15] may be associated with various factors such as the type of surgical incision used anesthetic techniques, postoperative pain and placement of the pleural drain, and median sternotomy change the compliance of the rib cage.

Ferreira *et al.* (2009)[16] observed the effects of a rehabilitation program of inspiratory muscles in the postoperative period of cardiac surgery, demonstrating increased Forced Vital Capacity (FVC) Maximum Voluntary Ventilation (MVV) and the ratio of forced expiratory volume in the first second (FEV1) and Forced Vital Capacity, pointing similarity between the initial and final measurements of maximal inspiratory and expiratory pressures former. Consistent with our study, the vital capacity values at the beginning and end of the training with Pilates exercises showed a significant increase in the intervention group compared to the control group.

Leguisamo *et al.* (2005)[17] conducted a study evaluating the impact from physical therapy intervention in the preoperative period of cardiac surgery, trying to see if there was influence on postoperative lung capacity, concluded that there is a reduction in lung capacity and respiratory muscle strength regardless of intervention.

In this article, there was no significant increase on the strength of the respiratory muscles, according to the study by Fonsêca[18], which evaluated a group of 33 healthy sedentary elderly, among which 16 held a Mat Pilates exercise program, totaling 24 sessions where there was no significant variation in respiratory muscle strength values.

During training in the intervention group, easy to perform exercises they were requested. However, due to some factors as motivation of the patient, presence of postoperative pain, difficulty of understand the therapist's commands, among others, they suffered interference, which can justify the little significant results in relation to strength of respiratory muscles.

In this study, the control group did not receive a specific inspiratory muscle training, but followed the physiotherapy routine of the institution, performing daily walking exercises, and receive instructions for performing deep breathing exercises in the proportion of 3 sets of 10 reps, daily, without equipment, which may have contributed to improve the MIP and MEP in this group.

There is a shortage of studies in the literature that address the applicability of the Pilates method in hospitals in patients after cardiac surgery. According to Gallagher & Kryzanowska (2000)[19] the method provides an improvement of oxygen in the tissues nutrition, coordination occurs on breathing, which accompanies the exercises, promoting the patient a respiratory rehabilitation and better ventilation and perfusion.

5. CONCLUSION

Based on this study, it was concluded that the application of respiratory muscle training using the Pilates method is ineffective to gain muscle strength in patients

after cardiac surgery. However, there was a significant effect on vital capacity, being a viable practice for improved ventilation in this patient's profile.

To carry out this study, it developed a specific program for training of the respiratory muscles based on Pilates principles. This program should be restructured on new research, with the application of more specific exercises to gain respiratory muscle strength, taking into account the lack of statistical significance of the results.

When comparing the results between conventional group (Control) and group Pilates (Intervention) realize that the respiratory muscle strength, did not obtain a significant difference. This absence of significance may be associated with the test sample used in our study. Thus, it is suggested that further studies be carried out by introducing the Pilates in the hospital, contemplating larger samples, with variation in intervention time.

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