Fisioterapia & Saúde Funcional

ARTIGO ORIGINAL

PILATES NO TRATAMENTO DA OSTEOARTRITE DE JOELHOS: ENSAIO CLÍNICO, CONTROLADO, CEGO E RANDOMIZADO

PILATES IN THE TREATMENT OF KNEE OSTEOARTHRITIS: RANDOMIZED, CONTROLLED, BLIND, CLINICAL TRIAL

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ABSTRACT

Background: Knee osteoarthritis causes mechanical and biochemical changes that lead to symptoms such as pain and joint stiffness, with a consequent limitation regarding physical functioning, especially in older people, and a reduction in quality of life. The Pilates method is composed of physical exercises, which have musculoskeletal benefits. Objectives: Evaluate whether apparatus-based Pilates reduces pain and improves physical functioning and quality of life in older people with knee osteoarthritis. Methods: A randomized, controlled, blind, clinical trial was conducted involving older people with knee osteoarthritis, who performed Pilates, in a studio, twice per week for a period of two months.Participants were randomized into experimental and control groups.Results: Fifty-four male and female volunteers 60 years of age or older participated in the study,with 27 in each group and they were evaluated at the beginning and end of the intervention.No significant differences were found in the reduction in pain (visual analog scale) or the improvement in physical functioning (WOMAC and Lequesne questionnaires) in the comparison of the groups. In contrast, an improvement was found in the vitality domain of the SF-36 questionnaire, favoring the Pilates group ($p = 0.042$). Conclusion: The Pilates method performed with equipment for a short period of time was not effective at improving pain or physical functioning in older people with knee osteoarthritis. However, those who practiced Pilates reported greater vitality in comparison to those who did not practice the method.

KEYWORDS: Osteoarthritis, Knee; Clinical Trial; Exercise Movement Techniques; Pain.

INTRODUCTION

Knee osteoarthritis is a chronic degenerative joint disease characterized by the destruction of cartilage, the formation of osteophytes and a self-inflammatory nature[1]. This is a slow-moving, progressive condition generating mechanical and biomechanical changes that produce symptoms such as pain and joint stiffness[2]. Such symptoms lead to a reduction in quality of life due to the limitations imposed on physical functioning and activities of daily living[3]. The prevalence of osteoarthritis of the knee is 19% among individuals older than 45 years of age and 50% among those older than 75 years of age, which poses an epidemiological concern, considering the increasing population of older people throughout the world[4].

As there is no prevention of osteoarthritis[2], it is fundamental to design treatments for the management of symptoms and the maintenance of functioning. Numerous studies have described treatments for osteoarthritis, including surgery, drug therapy and the practice of exercise. Intraarticular injections of steroids are not more effective than rehabilitation interventions, such as orthotics, exercises and nerve mobilization techniques[5]. A meta-analysis on exercises for older adults with knee osteoarthritis found that further studies are needed to validate of exercise modalities as treatment[6].

The Pilates method is a set of exercises executed either on the floor (mat Pilates) or with equipment (apparatus Pilates) and has six principles: concentration, precision, fluid movement, postural alignment, breathing and centering (contraction of the core)[7]. The aim is to achieve precise control of the body during each movement executed slowly and progressively, with the philosophy of training the body and mind when performing muscle work at a slow velocity, and may benefit older people with joint limitations[8].

The expected primary outcomes were a reduction in pain intensity and an improvement in physical functioning in the group submitted to Pilates training in comparison to the control group. Therefore, the aim of the present study was to evaluate whether apparatus Pilates exercises lead to a reduction in pain as well as improvements in physical functioning and quality of life in older people with knee osteoarthritis.

METHODOLOGY

Study design

The present randomized, controlled, blind, clinical trial received approval from the institutional review board of *Universidade Federal de São Paulo* (certificate number: 1.717.432). Registered in Brazilian Registry of Clinical Trials (ReBEC) number RBR-29jhy2r. There wasn't funding for this research.

Participants

Fifty-four male and female volunteers 60 years of age or older participated in the study. All volunteers had a diagnosis of knee osteoarthritis based on the criteria of the American Rheumatism Association[9]. The analysis of the radiographic exam and subsequent classification was performed by an experienced physiotherapist using the 1957 Kellgren and Lawrence grading system[10]. Patients with Grades I, II and III were included in the study: Grade I – arthrosis doubtful, narrowing of articular space doubtful, possible osteophyte on edge; Grade II – minimal osteoarthrosis, possible joint narrowing, definite osteophytes; Grade III – moderate arthrosis, definite joint narrowing, multiple moderate osteophytes, some subchondral sclerosis, possible deformity of bone contour. The volunteers also needed to have pain at rest with a score of 3 to 9 points on the visual analog scale[11].

Individuals were excluded from the study in two phases, as shown in Fig. 1. During the recruitment phase, 126 volunteers were excluded for having other diseases and conditions, such as stroke, Parkinson's, Alzheimer's, fibromyalgia, amputation, use of a pacemaker, unstable heart condition, having been submitted to knee or hip replacement surgery, severe vision or hearing impairment that requires an auxiliary device, having undergone physical therapy and/or physical exercise training in the previous three months, low level of schooling, uncontrolled blood pressure, Kellgren-Lawrence radiographic assessment classified as Grade 0 (normal radiology, without arthrosis) or Grade IV (severe arthrosis, notable narrowing of joint space, severe subchondral sclerosis, definite deformity of bone contour and large osteophytes).

In the follow-up phase, four volunteers were lost (two from the control group for not appearing for the final evaluation and two in the intervention group for missing three consecutive exercise sessions).

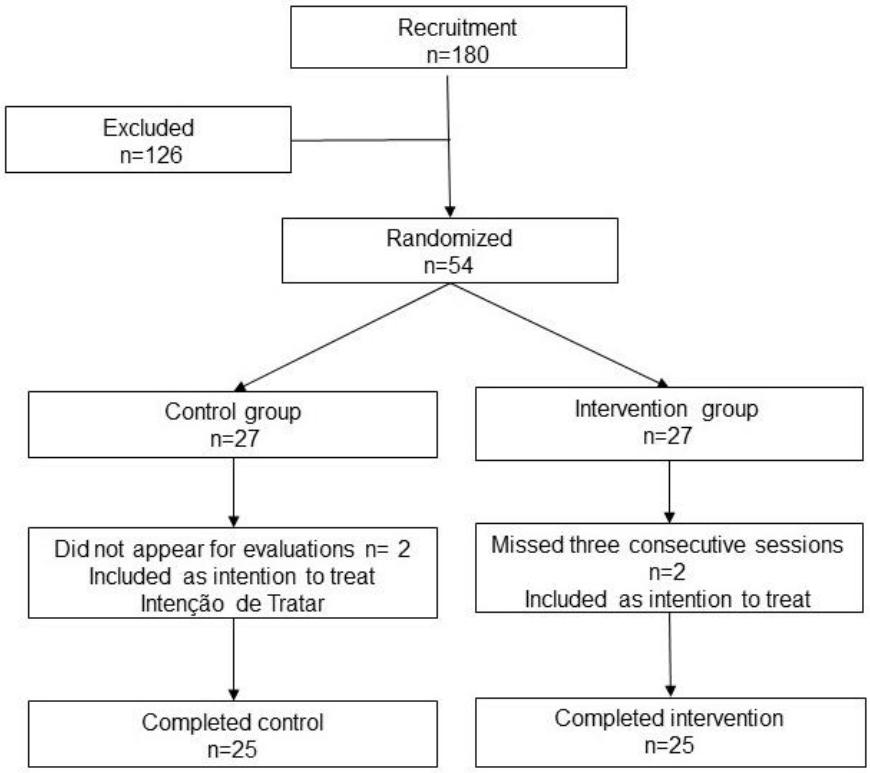

Figure 1. Flowchart of study.

Intervention

The participants in the intervention group were submitted to apparatus Pilates training under the supervision of a physiotherapist who was a specialist in the method. Prior to the onset of the intervention, the correct execution of each movement was demonstrated and the principles of the method were explained (breathing, concentration, precision, fluid movement, postural alignment and centering [contraction of core]). Two weekly 60-minute sessions were held on non-consecutive days for eight weeks, totaling 16 sessions. A 30-second rest interval was given between exercises. The pain level and physical fatigue of the participants were respected. The method was applied with a maximum of three volunteers per session, alternating among the different apparatuses. Training was divided into three stages: Stage I – measurement of blood pressure and initial warmup with the volunteer lying in the supine position on the equipment or mat; one set of 10 repetitions of breathing was performed in two different times; subsequently, combining breathing with shoulder flexion mobilization. This stage lasted approximately 10 minutes[12]. Stage II – conditioning with nine Pilates exercises on four equipment, all equipment manufactured by Real Pilates®: reformer universal – front splits (extension of knee supported on apparatus and return to initial position), scooter (extension of hip, pushing *reformer* and flexion of knee to return to initial position), footwork (extension of hips, knees and plantar flexion of ankles, followed by dorsiflexion

movement of ankles); *cadillac* apparatus - leg series supine lowers (extension and flexion of hips simultaneously and alternating, extension and flexion of hips and knees simultaneously and alternating, adduction and abduction of hips, circles and *frog),* leg series supine scissors (alternating extension and flexion of hips); *ladderbarrel* apparatus – trunk extension (extension of trunk and arms), stretches back (one lower limb supported on barrel with flexion of knee and back turned toward apparatus), stretches front (one lower limb supported on barrel, foot in plantar flexion or dorsiflexion); *combo chair* apparatus - hamstring stretch i and hamstring i (flexion of trunk, mobilizing vertebrae and supporting hand on bar). Strengthening exercises were performed in one set of six repetitions and stretching exercises were performed in one set, holding each pose for 30 seconds. This stage lasted 40 minutes. Stage III – relaxation: repetition of exercises performed in Stage 1 and final measurement of blood pressure. This stage lasted approximately 10 minutes[12](Oliveira et al., 2015).

The control group underwent periodic evaluations after continuing their activities of daily living, with no exercise counseling; if needed, an analgesic could be used in this period.

Evaluations

Pain at rest was assessed using the visual analog scale ranging from 0 (no pain) to 10 (unbearable pain)[11]. Physical functioning was assessed using the Western Ontario and McMaster Universities (WOMAC) questionnaire and physical functioning questionnaire for patients with knee osteoarthritis (Lequesne Index), both of which have been validated for the Portuguese language. The items on the questionnaires were read to the volunteers by an evaluator blinded to the allocation of the participants to the different groups. The WOMAC questionnaire has 17 questions addressing the degree of difficulty in performing activities of daily living, stiffness and pain. Each item is scored on a scale of 0 (none) to 4 (accentuated), using the previous 72 hours as reference. The total ranges from 0 to 68, with higher scores denoting worse physical functioning[13,14]. The Lequesne Index has 10 specific items related to pain, maximum distance travelled while walking and activities of daily living. The total ranges from 0 to 24 points, with higher scores denoting worse physical functioning[15].

The secondary outcome was an improvement in quality of life in the group submitted to Pilates training in comparison to the control group. Quality of life was measured using the 36-item Short Form Health Survey (SF-36), which is composed of eight subscales: physical functioning, physical role functioning, body pain, general health perceptions, vitality, social role functioning, emotional role functioning, and mental health. The score ranges from 0 to 100 for each subscale item, with higher scores denoting better quality of life[16].

Calculation of sample size

The sample size was calculated considering the WOMAC score as the response variable. For an 80% power and significance level of 0.05, 54 participants would be needed for the overall sample[17].

Randomization and blinding

A computer-generated randomization table was created by a skilled statistician. Opaque, sealed envelopes were then prepared by a third researcher not involved in any other phase of the study. At the end of the initial evaluation, each volunteer opened an envelope to determine to which group he or she was allocated. The envelope and content were then removed from the randomization process. Evaluations were performed by a blinded examiner, who administered the same questionnaires before and after the follow-up period.

Implementation

The volunteers were recruited through a public call placed on the internet and in local newspapers. All volunteers received clarifications regarding the procedures and were classified in terms of eligibility. Eligible volunteers who agreed to participate in the study signed a statement of informed consent. The study was developed at a Pilates School located in the city of Santos, São Paulo, Brazil. Four participants did not complete the reevaluations. Therefore, the results of the initial evaluation were carried forward to the final evaluation (intention-to-treat analysis).

Statistical analysis

Repeated-measures analysis of variance (ANOVA) was used to study the behavior the variables of interest according to group and evaluation time, followed by the Bonferroni multiple comparison method. The level of significance was set at 5% ($p < 0.05$)[17] (Neter et.al, 1996).

RESULTS

The overall sample of older people with knee osteoarthritis was composed of 83.33% women and 16.67% men. Mean age and standard deviation was 70.4 ± 6.0 years in the control group and 68.5 ± 5.7 years in the intervention group. Regarding the radiographic classification, 8.62% had Grade I knee osteoarthritis, 43.10% had Grade II and 48.28% had Grade III (table 1).

Table 1. Descriptive measures of age (expressed in years by mean and standard deviation), sex and Kellgren & Lawrence classification for knee osteoarthritis (frequency and percentage) according to group.

Variables	CG	IG	Total
	Mean ± SD	**Mean ± SD**	**(N) %**
Age	70.41 ± 6.05	68.52 ± 5.76	54 (100%)
	(N) %	**(N) %**	**(N) %**
Sex			
Male	(2) 3.71	(7) 12.96	(9) 16.67
Female	(25) 46.29	(20) 37.04	(45)83.33
Knee osteoarthritis			
Grade I	(3) 5.17	(2) 3.45	(5) 8.62
Grade II	(15) 25.86	(10) 17.24	(25) 43.10
Grade III	(12) 20.69	(16) 27.59	(28) 48.28

CG: control group; IG: intervention group; SD: standard deviation; N: frequency.

Table 2 displays the results of the inter-group analyses regarding pain, physical functioning and quality of life. Among all variables of interest, the only significant difference between groups was found for the vitality domain of the SF-36 quality of life questionnaire.

Table 2. Descriptive measures and analysis of significance of pain, physical functioning, and quality of life.

Variables	CG		IG		
	Before Mean ± SD	**After Mean ± SD**	**Before Mean ± SD**	**After Mean ± SD**	**p**
Pain					
VAS	6.15 ± 1.96	6.56 ± 2.53	6.50 ± 2.02	5.37 ± 3.05	0.06
Physical functioning					
WOMAC	41.19 ± 19.08	44.26 ± 22.20	47.44 ± 16.57	37.78 ± 14.89	0.30
LEQUESNE	12.33 ± 6.30	12.83 ± 6.39	13.41 ± 4.45	11.02 ± 4.00	0.40
Quality of life – SF = 36					
Physical functioning	49.07 ± 25.98	42.59 ± 26.22	37.04 ± 17.00	41.11 ± 14.96	0.148
Physical role functioning	44.44 ± 44.04	43.52 ± 44.18	39.81 ± 43.44	48.15 ± 39.18	0.457
Body pain	48.07 ± 21.24	47.22 ± 20.05	49.11 ± 25.32	53.78 ± 25.67	0.419
General health state	56.04 ± 14.43	52.11 ± 17.90	55.67 ± 13.38	58.33 ± 12.20	0.192
Vitality*****	56.48 ± 18.80	48.70 ± 23.06	57.78 ± 21.81	62.78 ± 20.58	0.035
Social role functioning	74.07 ± 23.75	68.98 ± 27.38	70.83 ± 26.85	75.93 ± 25.22	0.06
Emotional role functioning	54.32 ± 40.46	46.91 ± 41.61	58.02 ± 43.94	62.96 ± 42.70	0.216
Mental health	66.96 ± 20.20	63.41 ± 18.88	61.93 ± 25.77	62.52 ± 23.56	0.287

CG: control group; IG: intervention group; SD: standard deviation; ***** p = 0.042 significant difference. VAS – visual analog scale; WOMAC - Western Ontario and McMaster Universities questionnaire and LEQUESNE index – questionnaires of physical functioning for patients with knee osteoarthritis.

Figure 2 enables the visualization of the significant improvement in the vitality domain of the SF-36 quality of life questionnaire, showing an increase in mean value in the group that underwent the Pilates intervention compared to the control group.

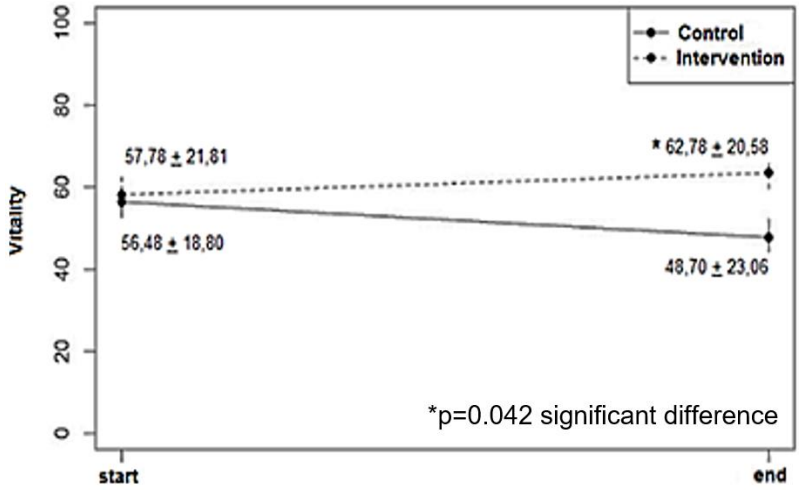

Figure 2. Variation of the vitality variable between the groups throughout the treatment.

DISCUSSION

Based on the results of the present study, the older people with knee osteoarthritis did not experience improvements in pain or physical functioning after eight weeks of apparatus Pilates. These findings differ from data on Pilates interventions for community-dwelling older people without osteoarthritis, who experienced improvements in pain and physical functioning and executed activities of daily living with greater ease[18].

A previous study on apparatus-based Pilates demonstrated improvements in quality of life and functioning among older people without knee osteoarthritis submitted to a 20-week intervention. However, the study reported no improvements in inflammatory markers in the cartilage or bone remodeling. These findings suggest that short-term exercises do not provide benefits in terms of cartilage or bone characteristics even in older people without a diagnosis of osteoarthritis[19].

An increase was found in the vitality domain of quality of life, which is in agreement with data from another clinical trial involving a 16-week intervention of mat Pilates, in which improvements were found in perceived health and sleep quality, which suggested that exercises using apparatus Pilates should be investigated, but the different techniques make comparisons difficult [20].

A recent qualitative study investigated the perceptions of patients with chronic conditions, including osteoarthritis, submitted to Pilates and concluded that there are motivational benefits for

adherence to the exercise program as well as better management of life and health [21]. In agreement with these findings, the older people who practiced Pilates in the present study reported greater vitality.

The present results can be explained by a recent meta-analysis, which described the benefits of Pilates training with regard to quality of life, physical functioning and pain following a longer intervention time (nine to 12 months) of exercises for older people with osteoarthritis [22]. Another systematic review reports that exercises led to improvements in physical functioning, evaluated using the WOMAC questionnaire, and an increase in the quality of life of individuals with knee osteoarthritis. However, the quality of the evidence was downgraded due to the heterogeneity of the measures, blinding problems and a lack of detailing of the interventions in the clinical trials analyzed [23].

A study evaluated the effectiveness of a progressive resistance exercise program for women with knee osteoarthritis, demonstrating positive effects with regards to pain, functioning, some aspects of quality of life and strength measures beginning with sixth week of training [24]. In the present study, however, the decision was made not to perform the progression of load on the springs of the Pilates equipment due to the fact that the exercises were not in closed kinetic chains, which would protect the joint. Thus, a progressive load would expose the volunteers to adverse effects on the joints due to the inflammatory characteristics of osteoarthritis.

The literature describes that the control of the intensity and level of effort are typically performed in a subjective manner by the instructor administering Pilates. When the practitioner performs a particular movement, the instructor must identify whether the exercise is being performed correctly (without postural compensations), which would enable an increase in the effort level [25]. Thus, due to the difficulty in quantifying resistance in the springs, the decision was made not to perform the progression of load on the Pilates equipment in the present investigation [12].

As observed in the present study, neither clinical nor statistical improvement was demonstrated, with the exception of vitality in the SF-36, in elderly patients with knee osteoarthritis submitted to the Pilates method. In view of this, we reinforce the importance of further studies with a different approach, either in the application of the method or in the duration of treatment. Reinforcing the importance of methodological rigor.

CONCLUSION

Based on the present findings, the Pilates method performed with apparatuses for a short period of time was not effective at improving pain or physical functioning in older people with knee

osteoarthritis. However, those who practiced Pilates reported greater vitality in comparison to those who did not practice the method.

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