Comparison of the effects of resistance exercise versus kinesiotherapy in knee osteoarthritis

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ABSTRACT
Increased life expectancy in several populations makes osteoarthritis (OA) an important public health issue, as it is a very prevalent chronic disease and leading cause of pain and disability among adults and elderly. Objective: The aim of this study was to compare pain, mobility, functional capacity, and strength of patients with knee osteoarthritis submitted to two different interventions: resistance exercise (REG) and kinesiotherapy (KIG). Methods: This was a prospective randomized single blind clinical trial, which involved the participation of 30 adults of both sexes diagnosed with knee OA. Volunteers were evaluated for pain, stiffness, function, functional mobility, and strength by a blinded evaluator before and after the interventions. Through a simple drawing, participants were randomly assigned to one of the two intervention groups, and underwent 15 twice-weekly treatment sessions, lasting 30 minutes each. Results: Both interventions promoted significant improvements in all variables, and there were no reports of any adverse effects throughout the research. Conclusion: Both resistance exercise and kinesiotherapy are effective in improving pain, stiffness, function, functional mobility, and strength in patients with knee OA.

Keywords: Osteoarthritis Knee, Exercise, Rehabilitation

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INTRODUCTION

Osteoarthritis (OA) of the knee brings various disabilities to its sufferers, who are mostly elderly individuals. This pathology is characterized by pain and progressive joint dysfunction, a result of the destruction of the subchondral bone and cartilage with consequent reduction of the articular space, inflammation, synovitis, and the formation of osteophytes. The knee is one of the most common joints affected by OA, generating functional deficits in 10% of individuals over the age of 55. With increasing life expectancy among several populations, including Brazil, OA should be considered a subject of public health interest, because it is a chronic disease and is a leading cause of pain and disability among adults and the elderly.

In addition to pain, those with OA can experience muscle weakness, joint stiffness, crepitations, deformities, and functional damages (such as difficulty in carrying out daily tasks) that negatively interfere in their quality of life.

Among the types of treatment for OA: drug therapy, surgery, and rehabilitation through exercises, and varying resources such as thermotherapy, cryotherapy, hydrotherapy, electrotherapy, ultrasound, laser, and even natural resources stand out; various therapeutic interventions are being tested with the objective of promoting symptomatic relief or improving the functionality of patients with OA.

One of the rehabilitation resources used in OA is physical and/or therapeutic exercise. Due to the possibility of promoting increased muscle strength, flexibility, proprioception, and the consequent reduction of pain, exercises relieve the symptoms of the disease. Thus, therapeutic exercise is recommended in numerous guidelines as the non-pharmacological intervention for the treatment of knee OA. However, it is worth emphasizing that there is still no consensus as to the parameters for the intensity and duration of each type of exercise.

In relation to exercises, two types stand out: resistance exercises (either using external load, one’s own body weight, elastic bands, or machines) that overload target muscles, and kinesiotherapy that encompasses different types of therapeutic and aerobic exercises (such as isotonic, isometric, and isokinetic stretching and strengthening).

OBJECTIVE

In view of evidence that both resistance exercise and kinesiotherapy can be beneficial in the treatment of knee OA, the objective of this study was to compare the pain, mobility, functional capacity, and strength in individuals with knee OA submitted to these two types of treatment.

METHODS

The present study was approved by the Ethics Committee in Research of the Centro Universitário Adventista de São Paulo (Report No. 243.745). All volunteers who participated in the consent form signed an informed consent form. This was a prospective, randomized, single blind clinical trial with 30 adult and elderly individuals of both sexes. The study was carried out on the premises of the Polyclinica Universitária and at the Sports Center (CENAPE) of the Centro Universitário Adventista de São Paulo (Unesp, São Paulo campus).

The participants were randomly directed for the OA). Individuals who had a total or partial prosthesis in one or both knees or hips, for the plantar flexor exercises for the flexor and extensor muscles of the hips and knees, and for the plantar flexor and dorsiflexors. The participants in this group also conducted a strengthening of these same muscle groups, using their own body weight as resistance. This step had duration of 20 minutes. The volunteers then performed a 10-minute walk in circuit, detouring around sleeping mats, hula hoops, stairs, and cones in order to work their coordination and proprioception.

The participants of the REG went through 30-minute supervised sessions, composed of a
warm-up (5 minutes walking on the treadmill), and a program of isotonic resistance exercises. The program consisted of 2 series of 8 to 12 repetitions of each of the following exercises: leg press, leg curl, calf raise, and leg extension, all running on Vitality machines (São José do Rio Preto - São Paulo, Brazil).

The exercises were performed unilaterally with an initial workload of 60% of the maximum load achieved in the 1-MR test on the weaker limb. The volunteers were instructed to perform the exercises with the technique indicated and to avoid the Valsalva maneuver. They were also instructed to rest for 30 to 60 seconds between the series. To promote a workload capable of promoting improvements throughout the treatment period, the intensity of the exercises was increased from 5 to 10% whenever the participants demonstrated adaptation to the load. This adaptation was considered to have occurred when 2 series of 12 repetitions of one of the proposed exercises were carried out perfectly with both legs without great apparent effort.

The data analysis was performed using the Graph Pad Instat statistical package. The data were presented as means ± standard deviations. The Kolmogorov-Smirnov test was used to verify the normality of the data from the variables studied. The basal characteristics of the two intervention groups at the beginning of the study were compared using the t-test (continuous variables) and Fisher’s exact test (categorical variables). The comparisons between the groups before and after interventions were made by means of two-way analysis of variance (ANOVA). In all cases, the α descriptive level was established at 5% (α < 0.05).

RESULTS

The study participants were recruited in the period from March 2014 to May 2015, totaling 232 patients with OA. Of this total, 178 were unable or unwilling to participate due to problems coming to the location of the study. Of the 54 chosen as likely participants of the research, 18 started other treatments concomitantly to the present study, and for this reason were excluded from the analysis. Thus, 36 individuals were randomized into the two intervention groups of this study. Three subjects left from each group, leaving 15 of each that went on to complete the treatment.

Throughout the research, there was no report of any adverse effect in any of the participants of the two groups (REG and KIG).

The general characteristics of each group are described in Table 1, which shows that the groups had similar characteristics.

There was effect of time in relation to the evaluations of pain, joint stiffness, and functionality (WOMAC), functional mobility (TUG), strength (dynamometry), and pain (visual analog scale) in both groups, and no differences were found between the interventions (Table 2).

DISCUSSION

The objective of this study was to compare the pain, mobility, and functional capacity of individuals with knee OA submitted to either resistance exercise or kinesiotherapy. The results showed that patients with OA can be benefited by either intervention, corroborating various other results that show improvements in symptoms of the disease with the practice of different types of exercise.11,13

In relation to the baseline data of the groups in this study, the homogeneity of the sample is noteworthy. In addition, two other factors are important. The first is the age of the participants (KIG = 61.67 ± 12.12 and REG = 59.20 ± 10.04) being within the parameters mentioned in the literature, which reveals greater prevalence of OA in individuals aged 55 years or more.3,22,23 The second factor is the excess weight, observed in both groups (BMI = 29.91 ± 4.09 in the KIG and 29.93 ± 3.16 in the REG). The relationship between overweight and obesity and OA is known, because the increased articular overload represents an important mechanical stress and leads to the worsening of the clinical presentation.24 For this reason, the participation in the exercise programs that, in addition to bringing functional benefits, will contribute to the reduction of body weight has been recommended to prevent and treat knee OA.25

An important variable analyzed in this study was the intensity of pain, evaluated by the VAS. In both groups, there was a decrease of pain, with neither group better than the other, showing that both types of exercises were able to reduce this important complaint of patients with OA.

Reducing pain is a crucial factor in motivating individuals with knee OA to exercise and to have autonomy for day-to-day activities, such as walking and climbing up and down stairs. In this sense, countless studies and reviews involving therapeutic exercise and resistance exercise have demonstrated success in the reduction of pain in these patients.11,12,14,20-29 Which can cause a natural increase in the level of physical activity, helping control weight and increasing physical capacity.

An association between physical function, pain, and joint stiffness has already been reported in patients with knee OA.9 In addition, pain and functional disability exert a negative impact on the quality of life of patients.30 Both interventions evaluated in this study produced a significant reduction in WOMAC scores (indicating reduced pain, joint stiffness, and functional improvement), a reduction of time in the TUG (indicating better functional mobility),

### Table 1. General characteristics of the sample

<table>
<thead>
<tr>
<th></th>
<th>KIG</th>
<th>REG</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15</td>
<td>15</td>
<td>0.69*</td>
</tr>
<tr>
<td>Males/females</td>
<td>6/9</td>
<td>4/11</td>
<td></td>
</tr>
<tr>
<td>Age (Years)</td>
<td>61.67 ± 12.12</td>
<td>59.20 ± 10.04</td>
<td>0.616</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>77.47 ± 8.93</td>
<td>75.57 ± 8.06</td>
<td>0.480</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>161.37 ± 9.36</td>
<td>158.91 ± 4.19</td>
<td>0.123</td>
</tr>
<tr>
<td>BMI (kg/cm²)</td>
<td>29.91 ± 4.09</td>
<td>29.93 ± 3.16</td>
<td>0.373</td>
</tr>
</tbody>
</table>

* Fisher’s exact test, BMI: body mass index, kg: kilograms, cm: centimeters; KIG: Kinesiotherapy Group; REG: Resistance Exercise Group. Data are expressed as mean ± standard deviation.

### Table 2. Evaluation of both groups before and after treatment

<table>
<thead>
<tr>
<th></th>
<th>KIG Before</th>
<th>KIG After</th>
<th>REG Before</th>
<th>REG After</th>
<th>Effect of Time</th>
<th>Effect of group</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOMAC</td>
<td>54.07 ± 19.41</td>
<td>47.73 ± 22.61</td>
<td>58.29 ± 16.06</td>
<td>42.21 ± 17.19</td>
<td>0.001</td>
<td>NS</td>
</tr>
<tr>
<td>TUG (s)</td>
<td>11.62 ± 2.35</td>
<td>9.89 ± 1.99</td>
<td>12.13 ± 3.15</td>
<td>10.87 ± 3.40</td>
<td>&lt; 0.001</td>
<td>NS</td>
</tr>
<tr>
<td>DINAM (kg)</td>
<td>64.60 ± 32.07</td>
<td>69.14 ± 31.96</td>
<td>56.64 ± 24.26</td>
<td>69.00 ± 22.62</td>
<td>0.006</td>
<td>NS</td>
</tr>
<tr>
<td>VAS (cm)</td>
<td>6.78 ± 2.48</td>
<td>4.59 ± 3.27</td>
<td>7.49 ± 2.47</td>
<td>5.98 ± 3.86</td>
<td>0.016</td>
<td>NS</td>
</tr>
</tbody>
</table>

Kg: kilograms, cm: centimeters; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; TUG: Timed Up and Go; DINAM: Dynamometry; VAS: Visual Analog Scale; KIG: Kinesiotherapy Group; REG: Resistance Exercise Group. Data are expressed as mean ± standard deviation. NS: without/Not statistically significant.
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The results of this study indicate that both the resistance exercises as kinesiotherapy interventions are capable of producing improvement in pain, joint stiffness, functionality, functional mobility, and strength of patients with knee OA. Thus, both represent effective methods for improving pain as well as functional and strength deficits that are characteristic of patients with knee OA. Future studies analyzing the severity of the disease, with larger samples and with even more precise methods of evaluating strength may contribute to the continuity of the study of the effects of the different rehabilitation techniques for such a debilitating disease.

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