Pelvic floor muscle training decreases hip adductors isometric peak torque in incontinent women: an exploratory study

Treinamento dos músculos do assoalho pélvico diminui o pico de torque isométrico de adutores de quadril em mulheres incontinentes: estudo exploratório

Grasiéla Nascimento Correia\textsuperscript{[a]}, Cristine Homsi Jorge Ferreira\textsuperscript{[b]}, Mariana Chaves Aveiro\textsuperscript{[c]}, Vanessa Santos Pereira\textsuperscript{[d]}, Patricia Driusso\textsuperscript{[e]}

\textsuperscript{[a]} Ph.D. student of Physiotherapy Department at Federal University of São Carlos (UFSCar), São Carlos, SP - Brazil, e-mail: grasiela_n_correia@yahoo.com.br

\textsuperscript{[b]} Professor of the Department of Biomechanics, Medicine and Rehabilitation of Locomotor System of Faculty of Medicine of Ribeirão Preto, Physiotherapy Post-Graduation Program (Rehabilitation and Functional Performance) at University of São Paulo (USP), Ribeirão Preto, SP - Brazil, e-mail: cristine@fmrp.usp.br

\textsuperscript{[c]} Professor of Human Movement Sciences Department at Federal University of São Paulo (Unifesp), Santos, SP - Brazil, e-mail: mariaveiro@yahoo.com

\textsuperscript{[d]} Ph.D. student of Physiotherapy at Federal University of São Carlos (UFSCar), São Carlos, SP - Brazil, e-mail: vanft05@yahoo.com.br

\textsuperscript{[e]} Physiotherapy professor at Federal University of São Carlos (UFSCar), São Carlos, SP - Brazil, e-mail: pdriusso@ufscar.br

Abstract

Introduction: The pelvic floor muscle (PFM) training is the most common treatment for urinary incontinence (UI), however many women performed the contraction of PFM with associated contraction of abdominal, gluteus and hip adductors muscles. Objective: To assess the effects of pelvic floor muscle (PFM) training on isometric and isokinetic hip adductors peak torque (PT) among women suffering from urinary incontinence (UI). Materials and methods: It is a longitudinal and prospective exploratory study. This study included 15 physically active women aged 45 years old and over, who presented complaints of UI. The PFM function (digital evaluation and perineometry), isometric and isokinetic hip adductors PT and one hour pad test were performed before and after treatment. The PFM training was performed in group, one hour once a week for 12 sessions. Results: Significant improvement of PFM function and pressure level (\(p = 0.003\)), and significant decrease of hip adductors isometric PT and one-hour pad test, were found post-treatment. Moderate negative correlations
between PFM contraction pressure and hip adductors isokinetic PT for dominant side (DS) \((r = -0.62; p = 0.03)\) and non-dominant side (NDS) \((r = -0.64; p = 0.02)\); and between PFM fast fibers contraction and hip adductors isometric PT for DS \((r = -0.60; p = 0.03)\) and NDS \((r = -0.59; p = 0.04)\) were also found. **Conclusions:** The PFM training decreased hip adductors PT and improved PFM functions and UI.

**Keywords:** Urinary incontinence. Pelvic floor. Torque. Group therapy. Physiotherapy.

**Introduction**

In clinical practice, pelvic floor muscle training (PFM) is the most common treatment for urinary incontinence (UI), as they are cheaper, noninvasive, effective and do not present undesirable collateral effects. However, many women do not perform these exercises correctly, for they usually contract the abdominal, glutea and hip adductors muscles along with PFM (1-4). This difficulty women present may be due to their wontedness to contract the PFM group voluntarily (1-4). Thus, they perform the PFM contractions with synergistic actions of other muscles with adjacent muscular insertions (5). Literature shows a relationship between PFM and abdominal, glutea and hip adductors contractions. Nonetheless, to our knowledge, there are no studies that evaluated the effects of PFM training on the hip adductors isometric and isokinetic peak torque (PT).

In this context, the hypothesis of this study was that PFM training would change hip adductors PT and improve function and pressure level of PFM among physically active women with UI. The purpose of this exploratory study was to assess the effects of a group-based PFM training on hip adductors isometric and isokinetic PT, PFM function and pressure level among women suffering from UI.

**Materials and methods**

This was a longitudinal and prospective exploratory study with a convenience sample. The Ethics Committee for Human Research of the University approved the study (report # 180/2008), which is in agreement with the Declaration of Helsinki and the Resolution n. 196/96 from National Health Council. Study procedures were explained to all volunteers and an informed consent term was obtained before any procedure. The study was developed from August 2008 to June 2009.

Fifteen physically active women aged 45 years old and over, who presented more than one episode of urinary loss in last month and had never undergone physical therapy for UI treatment were included in the study. Women were considered physically active...
Pelvic floor muscle training decreases hip adductors isometric peak torque in incontinent women

The perineometer Perina (Quark Medical Products, Piracicaba, Brazil), graded from 0 to 60 cmH₂O was used. Participants were placed at lithotomy position and the vaginal probe, previously covered by a condom (Microtex®) and lubricated (K-med® gel), was introduced 3.5 cm into the vagina. The equipment was then calibrated. Initially, participants performed two PFM contractions for familiarization with the procedures. After that, they performed a third contraction, which was the one considered for data analysis. PFM contractions were performed for three seconds (10). They were instructed to avoid performing abdominal, gluteus and hip adductors muscles contractions during maximum PFM evaluation (10, 11).

Hip adductors isometric and isokinetic PT were evaluated in the Biodex Multi-Joint System II isokinetic dynamometer. Tests were performed in the side-lying position, with the non-tested hip and knee flexed and fixed with straps. The dynamometer axis was aligned with the midpoint of the line linking the posterior superior iliac spine and the greater trochanter. The lever arm of the dynamometer was attached 5 cm above the superior patella border with straps (12, 13).

Initially, the dominant side, determined as the lower limb mostly used to kick a ball, was evaluated. Three 5-s isometric contractions with the hip at 30° of abduction were performed, with a 10-s rest period between them. Then, volunteers performed five isokinetic concentric contractions at 60°/s, with a range of motion set from 0° (neutral position) to 30° of hip abduction (13). After that, the non-dominant side was tested in the same fashion as the dominant side.

The PFM Training Group was formed by all participants, and consisted of 12 1-h sessions performed once a week in groups of 8-10 people. Exercises to strengthen PFM, information and guidance for UI were part of the treatment sessions. Initially, exercises were performed at supine and seated positions. Exercises evolved gradually, either by increasing the number of repetitions and/or the contraction time. Exercises then evolved to orthostatic position, squat and main situations that could induce urinary loss. Besides exercises, volunteers received basic information about UI, urinary system anatomy, self-care and food habits that could contribute to treatment.

The statistical analyses were performed using nonparametric tests, as the Shapiro-Wilk test showed a non-normal distribution of the variables. Comparisons between before and after treatment...
were made with the Wilcoxon test. Correlations between variables were performed by Spearman coefficient correlation. The level of significance used for all comparisons was 5% (p ≤ 0.05). The data are expressed as means ± standard deviations. Data analysis was performed with Statistica 7.0 software (Statsoft Inc© 1984-2004).

Results

Twenty-two women were included in the initial group, but only 15 completed the treatment protocol (Figure 1). Age ranged from 46 to 75 years old (60.20 ± 8.16), and Body Mass Index (BMI) ranged from 18.73 to 32.76 Kg/m² (26.30 ± 3.32).

After PFM training, 60% women became urinary continent. There was significant decrease in urinary loss measured by the one-hour pad test (p = 0.03); and an increase in PFM function, measured by perineometer (p = 0.005) and the PERFECT (p ≤ 0.001) after treatment (Table 1).

There was a significant decrease in hip adductors isometric PT for dominant (p = 0.04) and non-dominant (p = 0.02) sides after treatment (Table 2). Hip abductors isometric PT did not present significant differences after PFM training (Table 2).

No correlation between the initial evaluations was found; nonetheless, moderate negative correlations between PFM contraction pressure and hip adductors isokinetic PT for dominant side (r = -0.62; p = 0.03) and non-dominant side (r = -0.64; p = 0.02); and between contraction force of PFM fast fibers (fast) and hip adductors isometric PT for dominant side (r = -0.60; p = 0.03) and non-dominant side (r = -0.59; p = 0.04) were found at the end of the treatment (Table 3).

Table 1 - Outcomes of one-hour pad test, pelvic floor muscle function digital (PERFECT) and perineometer

<table>
<thead>
<tr>
<th></th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>One hour pad test</td>
<td>1.88 ± 2.85</td>
<td>0.46 ± 0.45</td>
<td>0.003</td>
</tr>
<tr>
<td>Perineometer</td>
<td>26.37 ± 24.92</td>
<td>41.13 ± 18.77</td>
<td>0.005</td>
</tr>
<tr>
<td>PERFECT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>1.93 ± 1.33</td>
<td>3.07 ± 0.70</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Endurance</td>
<td>4.53 ± 3.89</td>
<td>8.87 ± 1.85</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Repetition</td>
<td>3.07 ± 3.28</td>
<td>8.27 ± 2.31</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Fast fibers</td>
<td>5.27 ± 4.01</td>
<td>9.20 ± 1.70</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Source: Research data.

Table 2 - Isometric and isokinetic hip abductors and adductors peak torque

<table>
<thead>
<tr>
<th></th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isometric hip abductors PT ND</td>
<td>17.45 ± 8.58</td>
<td>21.56 ± 14.60</td>
<td>0.12</td>
</tr>
<tr>
<td>Isometric hip abductors PT D</td>
<td>16.09 ± 12.13</td>
<td>21.31 ± 15.04</td>
<td>0.10</td>
</tr>
<tr>
<td>Isokinetic hip abductors PT ND</td>
<td>28.41 ± 8.56</td>
<td>28.31 ± 10.51</td>
<td>0.48</td>
</tr>
<tr>
<td>Isokinetic hip abductors PT D</td>
<td>30.90 ± 12.59</td>
<td>28.86 ± 11.36</td>
<td>0.23</td>
</tr>
<tr>
<td>Isometric hip adductors PT ND</td>
<td>84.11 ± 18.49</td>
<td>76.40 ± 16.60</td>
<td>0.02</td>
</tr>
<tr>
<td>Isometric hip adductors PT D</td>
<td>84.26 ± 24.04</td>
<td>75.64 ± 22.52</td>
<td>0.04</td>
</tr>
</tbody>
</table>

(Continues)
Table 2 - Isometric and isokinetic hip abductors and adductors peak torque

<table>
<thead>
<tr>
<th></th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isokinetic hip adductors PT ND</td>
<td>48.44 ± 21.58</td>
<td>43.64 ± 15.36</td>
<td>0.16</td>
</tr>
<tr>
<td>Isokinetic hip adductors PT D</td>
<td>53.17 ± 26.90</td>
<td>49.46 ± 23.99</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Source: Research data.
Notes: PT = Peak torque; ND = Non-dominant; D = Dominant.

Table 3 - Correlation between final evaluation isometric and isokinetic hip adductors peak torque and one hour pad test, perineometer, pelvic floor muscle function digital

<table>
<thead>
<tr>
<th></th>
<th>Isometric ND</th>
<th>Isometric D</th>
<th>Isokinetic D</th>
<th>Isokinetic ND</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>p</td>
<td>r</td>
<td>p</td>
</tr>
<tr>
<td>One-hour pad test</td>
<td>-0.18</td>
<td>0.57</td>
<td>-0.10</td>
<td>0.73</td>
</tr>
<tr>
<td>Perineometer</td>
<td>-0.32</td>
<td>0.29</td>
<td>-0.42</td>
<td>0.16</td>
</tr>
<tr>
<td>PERFECT – Power</td>
<td>-0.38</td>
<td>0.22</td>
<td>-0.42</td>
<td>0.17</td>
</tr>
<tr>
<td>PERFECT– Endurance</td>
<td>-0.10</td>
<td>0.75</td>
<td>-0.04</td>
<td>0.89</td>
</tr>
<tr>
<td>PERFECT– Repeat</td>
<td>-0.26</td>
<td>0.40</td>
<td>-0.03</td>
<td>0.91</td>
</tr>
<tr>
<td>PERFECT– Fast</td>
<td>-0.59</td>
<td>0.04</td>
<td>-0.60</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Source: Research data.
Notes: D = Dominant; ND = Non-dominant.

Discussion

In the present study, 60% women became urinary continents after PFM training. This result is in agreement with other studies (4, 10, 14-17), which demonstrated that kinesiotherapy to strengthen the PFM presented good results for UI treatment, because strengthened the PFM (18-20), reducing the stress urinary incontinence and inhibited the involuntary contraction of the detrusor muscle (21, 22), decreasing the urge urinary incontinence.

The improvement of UI after the PFM training also is shown by other results found in this study, as: significant decreased of one-hour pad test, which agrees with Zanetti et al. (4) study; improvement in pressure level of PFM contraction, such as the studies of Bø et al. (11) and Sung et al. (1); and significant improvement PFM strength, as the study by Castro et al. (14).

However, the unpublished of this study is the significant decrease in hip adductors isometric PT and the negative correlations between hip adductors isokinetic PT and PFM contraction pressure, and between hip adductors isometric PT and PFM fast fibers contraction force after treatment. A possible explanation for this result is that volunteers were not sedentary and usually these women present urinary loss during physical activities (23-26), especially during those exercises that involve weight lifting or impact (27).

Due to urinary incontinence during physical activities, volunteers could have used the contracting abdominal, gluteus and hip adductors muscles in association to PFM (1-4) as a mechanism of urinary loss control during physical activities, increasing the hip adductors PT before of treatment. During PFM training, volunteers were instructed to avoid associated contractions, increasing the strength and pressure of contraction of PFM and decreasing associated contractions of hip adductor muscles after the training.

In literature it is clear the relationship between pelvic floor muscle with abdominal, gluteus and hip adductors muscles in women that never performed
the PFM training (1-4). Probably these synergic contractions occur due the nearness of insertion gluteus, abdominal and hip adductors muscles with pelvic floor muscle (5), and these women when try to contract the PFM, also recruit muscle fibers of abdominal, gluteus and hip adductors.

With the result of this study we can suggest that physical activities performed by women aged more 45 years old should be associated with orientation and training of PFM contractions. This is important to prevent and avoid the UI during physical activities (28-31). However, due the difficulty to contract the PFM voluntarily, it is indicated that an expert physiotherapist perform the PFM training. This conduct is important for avoiding that women acquire the habit to contract the PFM with the abdominal, gluteus and hip adductors, for avoid the UI during the physic activities.

Future studies would be to compare hip adductors PT between sedentary and non-sedentary with and without IU women submitted to PFM training, to evaluate the hip adductors PT, before and after PFM training in these different situations. There is the need for studies with control group, larger number of participants, with homogeneous age and BMI and that could include electromyography to evaluate the results along with those from the isokinetic dynamometer of hip adductors at beginning and the end of PFM training.

This study presented some limitations. As it was not possible to carry out urodynamic exams, it was not identified the type of urinary incontinence women had. However, according to the systematic review conducted by Dumoulin & Haysmith (32) and Thüroff et al. (33), PFM training should be the first option for stress, mixed and urge UI, which are the most common UI types in women. The digital PFM function and the perineometer were used as evaluation tools; nonetheless, the result of perineometer can be modified by intra-abdominal pressure and the amount of air inflated in perineometer probe, affecting the results obtained.

Conclusion

In conclusion, the PFM training decreased isometric hip adductors PT, improved PFM function and UI. There was a negative correlation between isometric hip adductors PT and PFM strength at the end of treatment in non-sedentary women suffering from UI. Probably, before PFM training, these women used the hip adductor contraction to avoid the urinary loss and after the treatment the participants learned PFM contraction, resulting in the decrease of hip adductor usage and the increase of PFM strength.

Acknowledgments

During the period of elaboration of this study, the authors had support of CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) and Capes (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior).

References


Received: 04/25/2012

Approved: 12/22/2012