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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

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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.

Resumo

Introdução*: O treinamento dos músculos do assoalho pélvico (MAP) é o tratamento mais comum para incontinência urinária (IU), entretanto a maioria das mulheres realiza a contração dos MAP associada com a contração do abdominal, glúteos e adutores de quadril.* ***Objetivos****: Avaliar os efeitos do treinamento dos MAP no pico de torque (PT) isométrico e isocinético de adutores de quadril em mulheres com incontinência urinária (IU).* ***Materiais e métodos****: Estudo longitudinal, exploratório e prospectivo. Foram incluídas 15 mulheres com IU, fisicamente ativas, com idade superior a 45 anos. A função dos MAP (avaliação digital e perineometria), o PT isométrico e isocinético de adutores de quadril e oteste do absorvente de uma hora foram realizadas antes e após o tratamento. O treinamento dos MAP foi em grupo, com duração de 12 sessões, uma hora por semana.* ***Resultados****: Houve aumento significativo da função e da pressão de contração (p = 0,003) dos MAP, e diminuição significativa do PT de adutores de quadril e do teste do absorvente de uma hora após o tratamento. Houve correlação negativa moderada entre a pressão de contração dos MAP e o PT isocinético de adutores de quadril do lado dominante (LD) (r = -0,62; p = 0,03) e não dominante (LND) (r = -0,64; p = 0,02); e entre contração de fibras rápidas dos MAP e o PT isométrico de adutores de quadril do LD (r = -0,60; p = 0,03) e LND (r = -0,59; p = 0,04).* ***Conclusão****: O treinamento dos MAP diminuiu o PT de adutores de quadril, melhorou a função dos MAP e da IU.*

Palavras-chave*: Incontinência urinária. Assoalho pélvico. Torque. Terapia em grupo. Fisioterapia*

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 unwontedness 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

if they performed 150 minutes or more of physical activity per week (6). Women presenting latex allergy, urinary and vaginal infection, inadequate vagina size to introduce perineometer probe, levels 3 or 4 pelvic prolapse, incapacity of perform voluntary contraction of PFM, neurologic or cognitive impairment, uncontrolled systemic arterial hypertension and some disability that could impair evaluation or treatment were excluded from the study (Figure 1).

Participants were evaluated by the same physical therapist at the beginning of the study and after treatment. Each volunteer's assessment included one clinical evaluation, one-hour pad test, digital and perineometer evaluation for PFM function and hip adductor isometric and isokinetic PT.

The one-hour pad test was carried out as the participants were instructed to place a pad, previously weighed on a precision weighing-machine (Denver instrument APx-200, New York, United States), and then drink 500 ml of water. After 30 minutes, they started performing a series of provocative exercises, accordingly to Abrams protocol (7), and at the end of one hour, the pad was removed, reweighed and the urinary loss was calculated. If urinary loss was greater than 1 g, the test was considered positive for UI (7).

Digital assessment of PFM (8) was performed with lubricating gel and sterile gloves, with participants in supine position covered by sheets and with knees flexed. In this position, the evaluator introduced two fingers up to one third of the vagina and then instructed participants to perform maximum PFM contraction. This test was carried out by a single physical therapist in order to minimize possible measurement errors. The Modified Oxford Grading Scale by Laycock (9) was chosen to grade muscle strength.

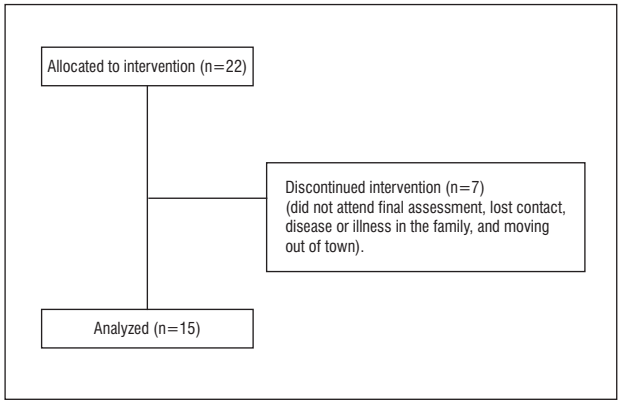

Figure 1 - Flow chart for volunteers' recruitment
Source: Research data.

The perineometer Perina (Quark Medical Products, Piracicaba, Brazil), graded from 0 to 60 cmH_2O 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% ($p \leq 0.05$). 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/m^2 (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 ($p \leq 0.001$) 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 perioneometer

	Pre-treatment	Post-treatment	p
One hour pad test	1.88 ± 2.85	0.46 ± 0.45	**0.003**
Perineometer	26.37 ± 24.92	41.13 ± 18.77	**0.005**
PERFECT			
Power	1.93 ± 1.33	3.07 ± 0.70	**< 0.001**
Endurance	4.53 ± 3.89	8.87 ± 1.85	**< 0.001**
Repetition	3.07 ± 3.28	8.27 ± 2.31	**< 0.001**
Fast fibers	5.27 ± 4.01	9.20 ± 1.70	**0.001**

Source: Research data.

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

(Continues)

	Pre-treatment	Post-treatment	p
Isometric hip abductors PT ND	17.45 ± 8,58	21.56 ± 14.60	0.12
Isometric hip abductors PT D	16.09 ± 12.13	21.31 ± 15.04	0.10
Isokinetic hip abductors PT ND	28.41 ± 8.56	28.31 ± 10.51	0.48
Isokinetic hip abductors PT D	30.90 ± 12,59	28.86 ± 11.36	0.23
Isometric hip adductors PT ND	84.11 ± 18.49	76.40 ± 16.60	**0.02**
Isometric hip adductors PT D	84.26 ± 24.04	75.64 ± 22.52	**0.04**

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

	Pre-treatment	Post-treatment	p
Isokinetic hip adductors PT ND	48.44 ± 21.58	43.64 ± 15.36	0.16
Isokinetic hip adductors PT D	53.17 ± 26.90	49.46 ± 23.99	0.25

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

	Isometric ND		Isometric D		Isokinetic D		Isokinetic ND	
	r	p	r	p	r	p	r	p
One-hour pad test	-0.18	0.57	-0.10	0.73	0.04	0.88	-0.003	0.99
Perineometer	-0.32	0.29	-0.42	0.16	**-0.62**	**0.03**	**-0.64**	**0.02**
PERFECT – Power	-0.38	0.22	-0.42	0.17	-0.45	0.13	-0.50	0.09
PERFECT– Endurance	-0.10	0.75	-0.04	0.89	0.17	0.57	0.20	0.51
PERFECT– Repeat	-0.26	0.40	-0.03	0.91	-0.26	0.40	-0.20	0.51
PERFECT– Fast	**-0.59**	**0.04**	**-0.60**	**0.03**	-0.49	0.10	-0.27	0.38

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 actives, 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 actives (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.

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