DOI: 10.1590/1809-2950/22009229032022EN

ORIGINAL RESEARCH

Two devices to facilitate the perception of pelvic floor muscle contraction in the sitting position in women with urinary incontinence: comparative analysis

Dois dispositivos facilitadores de percepção da contração do assoalho pélvico na posição sentada em mulheres com incontinência urinária: análise comparativa

Dos herramientas que facilitan la percepción de la contracción del suelo pélvico en posición sentada de mujeres con incontinencia urinaria: un análisis comparativo

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ABSTRACT | The use of support devices may facilitate the perception of pelvic floor muscle (PFM) contraction, which is difficult to be performed. Therefore, this study aimed to compare the perception of PFM contraction in the sitting position during the use of two different support devices on women with PFM dysfunction. This is a cross-sectional study performed with 37 women with stress or mixed urinary incontinence (UI). All women performed three free PFM contractions sitting on a chair, followed by three contractions using each support device (sand pads and a cylindrical foam, which provide sciatic and perineal support, respectively). Women scored the perception of PFM contraction from 1 to 5, as well as the perception of facilitation of contraction (higher grades show better results) and discomfort (higher grades show more discomfort) when compared with free contraction. The cylindrical foam presented similar results to sand pads for the perception of PFM contraction (2.84±1.61 vs. 3.19±1.43; p=0.34) and facilitation of contraction (3.38±1.34 vs. 3.19±1.54; p=0.61), as well as for their discomfort (1.83±1.23 vs. 1.5±1.16; p=0.20). Of all women, 57% preferred sand pads. Thus, both sand pads (sciatic support) and the cylindrical foam (perineal support) improved the perception of PFM contraction and facilitation of contraction in the sitting position of women with PFM dysfunction when compared with sitting with no device. The two devices presented no difference between them.

Keywords | Muscle Contraction; Pelvic Floor; Physical Therapy; Urinary Incontinence.

RESUMO | O uso de dispositivos de suporte pode auxiliar na percepção da contração dos músculos do assoalho pélvico (AP). O objetivo deste estudo foi, comparar na posição sentada, a percepção da contração dos músculos do AP durante o uso de dois tipos diferentes de dispositivos, em mulheres com disfunção dos músculos do AP. Para tanto, foi realizado um estudo transversal com 37 mulheres com incontinência urinária (IU) de esforço ou mista. Primeiro as participantes faziam três contrações livres dos músculos do AP sem o uso de dispositivos, sentadas em uma cadeira. Em seguida, faziam três contrações utilizando cada um dos dois dispositivos: almofadas de areia e uma espuma cilíndrica, que forneciam apoio isquiático e perineal, respectivamente. As pacientes atribuíram nota de 1 a 5 para a percepção que tiveram da contração dos músculos do AP, da facilitação da contração (quanto maior a nota, melhor o resultado) e do desconforto com o dispositivo (quanto maior a nota, maior o desconforto) em comparação às contrações livres. Como resultados

This study was conducted at the Urogynecology Outpatient Clinic of the Hospital das Clínicas, School of Medicine, Universidade de São Paulo.
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principais, verificou-se que o uso da almofada cilíndrica foi similar ao das almofadas de areia para a percepção da contração dos músculos do AP (2,84±1,61 vs. 3,19±1,43; p=0,34), e da facilitação da contração (3,38±1,34 vs. 3,19±1,54; p=0,61), assim como do desconforto (1,83±1,23 vs. 1,5±1,16; p=0,20). Entre as participantes, 57% relataram preferir as almofadas de areia. Concluiu-se que em mulheres com incontinência urinária, tanto as almofadas de areia (apoio isquiático) quanto a espuma cilíndrica (apoio perineal) melhoraram a percepção da contração e facilitaram a contração dos músculos do assoalho pélvico na posição sentada, não havendo, no entanto, diferença entre os dispositivos.

Descritores | Contração Muscular; Assoalho Pélvico; Fisioterapia; Incontinência Urinária.

RESUMEN | Las herramientas de apoyo pueden ayudar en la percepción de la contracción de los músculos del suelo pélvico (SP), que no siempre es fácil de obtener su medición. El objetivo de este estudio fue comparar si dos tipos diferentes de herramientas ayudan a las mujeres con disfunción muscular del SP a contraer estos músculos en posición sentada. Para ello, se realizó un estudio transversal con 37 mujeres con incontinencia urinaria (IU) de esfuerzo o mixta. Primero, las participantes realizaron tres contracciones libres de los músculos del SP sentadas en una silla, sin el uso de herramientas de apoyo. Luego, realizaron tres contracciones utilizando cada uno de los dos dispositivos de apoyo: almohadillas de arena y espuma cilíndrica, que brindan apoyo isquiático y perineal, respectivamente. Las participantes deberían asignar una puntuación de 1 a 5 cuanto a su percepción de la contracción muscular del SP, de la facilitación de la contracción (cuanto mayor sea la puntuación, mejor será el resultado) y la incomodidad con la herramienta (cuanto mayor sea la puntuación, mayor será la incomodidad) en comparación con las contracciones libres. Los principales resultados encontrados apuntan que el uso de la almohadilla cilíndrica fue similar al de las almohadillas de arena en cuanto a su percepción de la contracción de los músculos del SP (2,84±1,61 *vs.* 3,19±1,43; p=0,34), y la facilitación de la contracción (3,38±1,34 *vs.* 3,19±1,54; p=0,61), así como la incomodidad (1,83±1,23 *vs.* 1,5±1,16; p=0,20). El 57% de las participantes informó preferir las almohadillas de arena. Se concluyó que tanto las almohadillas de arena (apoyo isquiático) como la espuma cilíndrica (apoyo perineal) mejoraron la percepción y la facilitación de la contracción muscular del SP en posición sentada de mujeres con disfunción muscular del SP en comparación con la ausencia de la herramienta, sin embargo, hay no hubo diferencia entre las herramientas.

Palabras clave | Contracción Muscular; Diafragma Pélvico; Fisioterapia; Incontinencia Urinaria.

INTRODUCTION

The pelvic floor is constituted of muscles, fasciae, and ligaments. It is anchored by the iliac, ischial, and pubic bone structures and acts as a support for the bladder, reproductive organs, and rectum[1], playing an extremely important role in urinary continence. Urinary continence depends on the coordination among bladder, urethra, pelvic floor muscles, and nervous system[2]. Failures in this mechanism result in incontinence due to intrinsic sphincter deficiency or ineffectiveness in the action of muscles, connective tissues, and neural structures[3].

Urinary incontinence (UI) is an involuntary loss of urine. It affects more women and the prevalence increases as age advances, a peaking from 50 to 54 years old. Many cases are not reported or not referred to medical service, since the prevalence ranges from 25% to 45%[4,5]. UI patients report discomfort, frequent trips to the bathroom, limited fluid intake, embarrassment, and social isolation, which impair their quality of life[6].

Specific pelvic floor muscle therapy performed by specialists in pelvic floor rehabilitation should be the first choice to treat stress UI (SUI)[4,5,7]. Although no consensus exists yet[8], the exercises usually begin with women lying down and evolve to the sitting and then standing position, as different positions influence the difficulty level of the exercises especially due to the action of gravity on the pelvic organs[4,9].

Assessing if patients properly perform pelvic floor muscle contraction is greatly significant to clinical practice and most studies on training these muscles[10,11]. However, patients may have difficulty to understand and be able to perform the contraction of pelvic floor muscles[12-14], thus, they need some type of assistance to reduce the lack of awareness.

Training in the sitting position—which is adopted during a considerable part of the day—could optimize the pelvic floor function. The use of support devices, to both bones and pelvic floor, could facilitate the perception and understanding of women for the correct contraction of these muscles. The type of device and its position during

pelvic floor muscle contraction could promote different experiences to individuals. Therefore, this study aimed to compare the perception of women with SUI when using two types of support devices, different in shape in the sitting position, regarding discomfort while using them and improvement of the perception of pelvic floor muscle contraction and facilitation of contraction.

METHODOLOGY

This is a cross-sectional study with a convenience sample of patients of the Urogynecology Outpatient Clinic of the Hospital das Clínicas, School of Medicine, Universidade de São Paulo.

After the diagnosis of stress or mixed urinary incontinence by a physician, who was not involved in this study, all included women were informed about the study aims and its procedures, signing an informed consent form. Then, women were evaluated by a physical therapist with two years of experience in women's health. Data on gynecological and obstetric history, characteristics of urinary incontinence, eating, and hygienic habits were recorded.

Women aged from 18 to 65 years with a clinical diagnosis of stress or mixed urinary incontinence and pelvic floor dysfunction scored greater than or equal to 2 according to the Oxford scale (which shows low-intensity contraction that is sustained) were included[15]. Since this study was based on the participants' perception, they had to be able to perform PFM contraction so that they could compare the contractions performed with and without the devices. Women with neurological disorders, current or recurrent genitourinary tract infection, pelvic organ prolapse with a degree greater than or equal to 2 according to the Pelvic Organ Prolapse Quantification System (POP-Q)[16], cognitive problems that would impair the learning of the contraction, sexually transmitted diseases, suspected pregnancy, or women who were already pregnant were excluded.

ASSESSMENTS

The effect of UI on the quality of life of women was assessed using the International Consultation on Incontinence Questionnaire – Short Form (ICIQ-SF)[17,18]. The ICIQ-SF is a self-administered questionnaire with three questions about the frequency, severity, and effect of urinary incontinence on the quality of life of the responder and an item that involves eight self-diagnosis questions, related to situations when the loss of urine occurs and the causes of urinary incontinence. The ICIQ-SF score ranges from 0 to 21. The classification of the effect on the quality of life is none if the score is zero, mild if the score ranges from 1 to 5, moderate if the score ranges from 6 to 12, severe if the score ranges from 13 to 18, and very severe if the score ranges from 19 to 21[19].

For the pelvic floor assessment, the trained physical therapist asked each woman to perform effective pelvic floor muscle contractions in a lying position. The verbal instruction was: "Squeeze around my fingers and lift your PFM." Then, the muscle contraction strength was classified according to the modified Oxford scale (MOS)[15]. Its score ranges from 0 (no contraction) to 5 (strong contraction) and all women performed the assessment with firm compression of the physical therapist's finger and movement towards the pubic symphysis. The PERFECT scheme[15] was also used to quantify the intensity and number of slow and fast contractions and the holding time for slow contractions.

In order to verify if contractions were performed and if the verbal instructions were correctly understood, women were asked to contract their pelvic floor muscles while the physical therapist performed vaginal palpation. Contractions performed in association with pelvic retroversion or the Valsalva maneuver were considered inadequate. All women were instructed before pelvic floor assessment[20].

Digital palpation is a well-stablished method of pelvic floor assessment frequently used in both clinical practice and research[21]. Previous literature showed a strong correlation with electromyography[10] and a 0.739 ($p<0.001$) correlation index.

The pressure strength test of the pelvic floor muscles was quantified with the Peritron 9300 AV perineometer (Cardio-Design, Australia). This device is used to measure the increase in intravaginal pressure produced by muscle contraction[10]. All women performed a three maximum contractions and the highest value was used for the analysis.

EVALUATION OF THE EFFECT OF FACILITATING DEVICES

To evaluate the effect of facilitating devices on the perception of women, initially, they performed three pelvic floor muscle contractions sitting on a chair, following the

verbal instructions of the physical therapist performing the assessment. This was considered the reference contraction. Later, they were instructed to repeat the procedure using one of the two facilitating devices at a time, which were selected in random order, in an even proportion. A pelvic floor prop (PFProp) (Orthopedic Physical Therapy Products, United States) (Figure 1) and sand pads for the ischial bones (Figure 2) were the facilitating devices used.

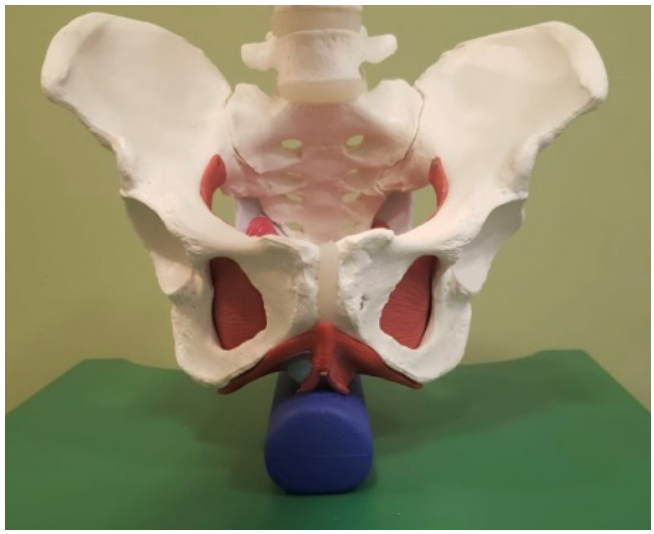

Figure 1. PFProp, a cylindrical foam, which is placed under the pubic region, perpendicular to the frontal plane

Figure 2. Sand pads, positioned under each ischium, providing sciatic support

PFProp is a cylindrical foam (20.32cm×4.44cm×3.81cm) specifically designed to be used during pelvic floor exercises in a sitting position. According to the manufacturer's guidelines, it should be placed under the pubic region, perpendicular to the frontal plane. Sand pads (19cm×10cm×2.5cm; 1.0kg) are ordinary homemade pads easily found in non-specialized stores. They were placed under each ischium, providing sciatic support. PFProp was chosen because it is a specific device found in the market and aims to facilitate pelvic floor muscle contraction. Sand pads were chosen because they were a cheap and accessible material.

After using each device, the physical therapist asked women to score from 1 to 5: (1) the facilitation of pelvic floor muscle contraction, (2) the perception of contraction, and (3) the discomfort felt with each device, in comparison with the reference contraction. Women should give a grade to the devices, in comparison with the reference contraction, and this grade was assigned separately to each topic. Regarding the perception of contraction and facilitation of contraction, 5 indicated high perception and 1 indicated no perception. Regarding discomfort, 1 indicated no discomfort and 5 indicated high discomfort. The perception of contraction refers to the recognition of an active contraction of the pelvic floor muscles while the perception of facilitation of contraction refers to the ease of performing it. All women were instructed about this difference. All data were collected in a single visit.

Clinical and demographic variables were subjected to descriptive analysis. Continuous variables were presented as mean and standard deviation and categorical variables were presented as frequency. The score given to the items of the questionnaire for each device were compared using a paired t-test. A 5% significance level was adopted. The software used was SigmaStat.

RESULTS

We recruited 60 women for this study, however, eight of them did not attend on the scheduled day and 15 did not meet the inclusion criteria, totaling 37 women in the study (Figure 3). They were aged 49.81±10.01 years and had BMI=30.96±6.38kg/m^2 and 9.97±3.22 years of schooling. Table 1 shows data on participants' characteristics. The means presented in the PERFECT scheme show a moderate muscle contraction, with low endurance and few repetitions, while the mean score of ICIQ-SF shows a high severity.

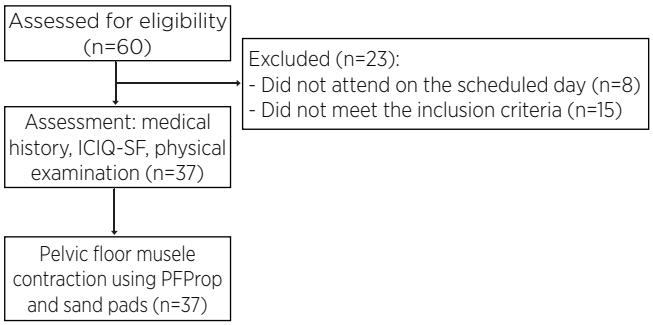

Figure 3. Flowchart of the study

Table 1. Baseline characteristics of women (n=37)

Characteristic	
Age (years old)	49.81±10.1
BMI (kg/m^2)	30.96±6.38
Schooling level	
Less than 8 years of schooling	9 (24.3%)
From 8 to 10 years of schooling	6 (16.2%)
From 11 to 14 years of schooling	16 (43.3%)
15 years of schooling or more	6 (16.2%)
Smoking	7 (18.9%)
Alcoholism	3 (8.1%)
Regular physical activity	13 (35.1%)
Number of pregnancies	2.49±1.46
Number of vaginal childbirths	1.49±1.16
Weight of the biggest baby (g)	2656±1505
Daily water intake (l)	1.42±0.6
Nocturia (number of times per night)	1.81±1.45
Sexual satisfaction (from 0 to 10)	4.68±3.69
Interference of UI in her quality of life (from 0 to 10)	6.92±2.13
Perineometry (cmH_2O)	35.5±21.7
PERFECT scheme	
Power	3.16±0.9
Endurance	4.35±2.95
Repetitions	2.84±2.15
Fast	7.43±6.86
ICIQ-SF	13.32±3.46

BMI: body mass index; UI: urinary incontinence; ICIQ-SF: International Consultation on Incontinence Questionnaire – Short Form. Continuous variables are presented as mean±standard deviation and categorical variables are presented as absolute and relative numbers. Women scored sexual satisfaction and the interference of urinary incontinence in their quality of life with a scale of 0 (lowest) to 10 (highest).

The use of PFProp and sand pads presented similar scores for the facilitation of pelvic floor muscle contraction (2.84±1.61 vs. 3.19±1.43; p=0.34), perception of contraction (3.19±1.54 vs. 3.38±1.34; p=0.61), and discomfort during their use (1.5±1.16 vs. 1.83±1.23; p=0.2). The devices showed no statistically significant difference for any variable.

Regarding the preference for using PFProp or sand pads, 56.8% of women preferred sand pads.

DISCUSSION

Although no device proved to be superior, both were able to facilitate and to increase the perception of contraction in comparison with the contraction without them. The use of PFProp facilitates the perception because it promotes an external sensory stimulation, providing a continuous pressure in the perineal region and, therefore, leading to greater body awareness and proprioception, which makes voluntary contraction easier. Sand pads, on the other hand, have a contact area with the glutes and ischiatic bones that may provide a feeling of openness in the pelvic structures, as the pubic region is not directly supported. This perception, due to sensory stimulation, makes voluntary contraction easier. Therefore, both devices increased the lower pelvic and pelvic floor awareness from afferent information and proprioceptive signals.

This topic has been little explored in the literature, but Kubota et al.[22] assessed the effects and effectiveness of breathing exercises with attention to the pelvic floor muscles in men, using a cylindrical foam. Initially, men were instructed to perform pelvic floor muscle contraction sitting on a chair, following verbal instructions. After one week, the experiment was repeated with the cylindrical foam positioned on the seat. This time, men were asked to perform breathing exercises (moving their upper limbs), focusing on the contraction. Contractions were assessed using images made with an ultrasound device and the pubic symphysis as an anatomical reference. The analysis was based on the movement of the posterior side of the bladder in comparison with the resting position. Kubota et al. also performed a subjective assessment of the perception of men using a numerical scale. Results showed an increase in both the voluntary contraction measurement with ultrasound and the perception of contraction[23].

In this study, regardless of the type of stimulus, both devices proved to facilitate contraction and the perception of contraction in comparison with the exercise performed without them, making these devices interesting options for the therapy of women with difficulty to perform a correct contraction. An adequate contraction is clinically identified by vaginal palpation, thus, the examiner's fingers compress and elevate the region[23,24]. However, studies show that 30% to 50%[23,25,26] of women cannot perform an adequate contraction of their muscles when asked.

Physical therapy, with pelvic floor muscle training, is the first-line treatment option for urinary incontinence,

since perineal function and effective urinary continence are significantly related[27,28]. Usually, women with urinary incontinence have worse pelvic floor muscle strength than women without urinary continence[11,26].

Reduced perineal awareness is possibly one of the main difficulties in pelvic floor muscle training. Perineal reeducation could improve proprioception and minimize the use of associated accessory muscles[26]. Pinheiro et al.[26] showed that kinesiotherapy with digital touch or biofeedback are efficient options to develop perineal awareness, with no statistically significant difference between the two methods.

Mateus-Vasconcelos et al.[23] evaluated the effectiveness of three resources in the facilitation of pelvic floor muscle contraction in women: vaginal palpation, vaginal palpation associated with pelvic retroversion, and intravaginal electrical stimulation and observed that vaginal palpation with pelvic retroversion and vaginal palpation alone presented better results when compared with intravaginal electrical stimulation and the control group[23]. Another study evaluated the use of vibration to stimulate the pelvic floor muscle activation and also obtained good results[29]. A study on methods to facilitate pelvic floor muscle contraction evaluated the use of instructions on the anatomy and function of these muscles, vaginal palpation, palpation in the central tendon of the perineum, interruption of urinary flow, biofeedback with perineometer, vaginal cones, hypopressive exercises, pelvic floor muscle contraction associated with diaphragmatic breathing, and abdominal muscle coactivation. All methods proved to be effective and presented no adverse effects[26]. However, in the sitting position, many of these methods are limited due to the support of the perineal region.

The ease of performing pelvic floor muscle contraction also varies according to the position of women. Although the supine position is the most used in research and clinical assessments, UI usually begins and is more pronounced when women are standing, as the force of gravity and the pressure of the pelvic organs on the pelvic floor muscles are more significant[30-32].

Previous studies, which aimed to compare the muscle activity in different body positions, observed that the resting pressure was lower in the less demanding position. Thus, this pressure is greater in the sitting and standing position than in the supine position. Frawley et al. also showed that the results of digital muscle tests and vaginal pressure changed according to the body positioning and usually the supine position presented higher muscle strength and generating more pressure than the standing position[31]. Sapsford et al.[33] also assessed if the activation level of the pelvic floor changes in different sitting positions in healthy women and showed that the muscle activity significantly raised as the demand increased[33].

Thus, we aimed to compare the use of two devices to facilitate pelvic floor muscle contraction in women with stress UI in the sitting position, since these devices could help in their therapy and rehabilitation. Most facilitation methods are intracavitary, such as vaginal palpation and biofeedback. However, these resources disturb the contraction and are difficult to be used in the sitting position. Therefore, having extracavitary options, such as those we evaluated, is important.

While the use of PFProp is a patented alternative, as it is not available in the market of some countries yet, such as Brazil, sand pads are not expensive and are easy to make (only fabric and sand are necessary). Thus, both devices can be used in clinical practice for pelvic floor muscle training. Moreover, our results show that a method does not need to be specific, but it can be adapted based on knowledge of the biomechanics of the pelvis and the preference of each patient, according to the type of stimulus to which patients best adapt.

A limitation of the study was the use of a convenience sample, which was probably not large enough to determine differences between the two devices, however, this study aimed to be a pilot study so that, in the future, further studies can be performed to evaluate the clinical effect of using these devices. Moreover, we obtained no objective measurement of pelvic floor muscle contraction due to the difficulty of using the perineometer in women in the sitting position.

CONCLUSION

Sand pads (sciatic support) and PFProp (perineal support) are able to subjectively facilitate pelvic floor muscle contraction and the perception of contraction in women with SUI in the sitting position when compared with the contraction performed without them. The devices presented no difference between them regarding facilitation of contraction, perception of contraction, or discomfort.

The generalizability of our results is restricted to women with stress or mixed urinary incontinence who are able to perform at least a small-intensity but sustained pelvic floor muscle contraction.

REFERENCES

1. Eickmeyer SM. Anatomy and physiology of the pelvic floor. Phys Med Rehabil Clin N Am. 2017;28(3):455-60. doi: 10.1016/j.pmr.2017.03.003.
2. Verghese T, Latthe P. Recent status of the treatment of stress urinary incontinence. Int J Urol. 2014;21(1):25-31. doi: 10.1111/iju.12238.
3. McLean L, Varette K, Gentilcore-Saulnier E, Harvey MA, Baker K, Sauerbrei E. Pelvic floor muscle training in women with stress urinary incontinence causes hypertrophy of the urethral sphincters and reduces bladder neck mobility during coughing. Neurourol Urodyn. 2013;32(8):1096-102. doi: 10.1002/nau.22343.
4. Dumoulin C, Cacciari LP, Hay-Smith EJC. Pelvic floor muscle training versus no treatment, or inactive control treatments, for urinary incontinence in women. Cochrane Database Syst Rev. 2018;10(10):CD005654. doi: 10.1002/14651858.CD005654.pub4.
5. Hay-Smith J, Mørkved S, Fairbrother KA, Herbison GP. Pelvic floor muscle training for prevention and treatment of urinary and faecal incontinence in antenatal and postnatal women. Cochrane Database Syst Rev. 2008;(4):CD007471. doi: 10.1002/14651858.CD007471. Update in: Cochrane Database Syst Rev. 2012;10:CD007471.
6. Silva JCP, Soler ZASG, Wysocki AD. Associated factors to urinary incontinence in women undergoing urodynamic testing. Rev Esc Enferm USP. 2017;51:e03209. doi: 10.1590/S1980-220X2016140903209.
7. Jácomo RH, Fitz FF, Alves AT, Fernandes IS, Teixeira FA, Sousa JB. The effect of pelvic floor muscle training in urinary incontinent elderly women: a sistematic review. Fisioter Mov. 2014;27(4):675-89. doi: 10.1590/0103-5150.027.004.AR02.
8. Dumoulin C, Glazener C, Jenkinson D. Determining the optimal pelvic floor muscle training regimen for women with stress urinary incontinence. Neurourol Urodyn. 2011;30(5):746-53. doi: 10.1002/nau.21104.
9. Marques SAA, Silveira SRB, Pássaro AC, Haddad JM, Baracat EC, Ferreira EAG. Effect of pelvic floor and hip muscle strengthening in the treatment of stress urinary incontinence: a randomized clinical trial. J Manipulative Physiol Ther. 2020;43(3):247-56. doi: 10.1016/j.jmpt.2019.01.007.
10. Frawley HC, Galea MP, Phillips BA, Sherburn M, Bø K. Reliability of pelvic floor muscle strength assessment using different test positions and tools. Neurourol Urodyn. 2006;25(3):236-42. doi: 10.1002/nau.20201.
11. Amaro JL, Moreira ECH, Gameiro MO, Padovani CR. Pelvic floor muscle evaluation in incontinent patients. Int Urogynecol J Pelvic Floor Dysfunct. 2005;16(5):352-4. doi: 10.1007/s00192-004-1256-3.
12. Stensgaard SH, Moeller Bek K, Ismail KMK. Coccygeal movement test: an objective, non-invasive test for localization of the pelvic floor muscles in healthy women. Med Princ Pract. 2014;23(4):318-22. doi: 10.1159/000362337.
13. Bø K, Kvarstein B, Hagen RR, Larsen S. Pelvic floor muscle exercise for the treatment of female stress urinary incontinence: II. Validity of vaginal pressure measurements of pelvic floor muscle strength and the necessity of supplementary methods for control of correct contraction. Neurourol Urodyn. 1990;9(5):479-87. doi: 10.1002/nau.1930090504.
14. Bump RC, Hurt WG, Fantl JA, Wyman JF. Assessment of Kegel pelvic muscle exercise performance after brief verbal instruction. Am J Obstet Gynecol. 1991;165(2):322-7; discussion 327-9. doi: 10.1016/0002-9378(91)90085-6.
15. Laycock J, Jerwood D. Pelvic floor muscle assessment: the PERFECT Scheme. Physiotherapy. 2001;87(12):631-42. doi: 10.1016/S0031-9406(05)61108-X.
16. Bump RC, Mattiasson A, Bø K, Brubaker LP, DeLancey JO, Klarskov P, et al. The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction. Am J Obstet Gynecol. 1996;175(1):10-7. doi: 10.1016/s0002-9378(96)70243-0.
17. Avery K, Donovan, J, Abrams P. Validation of a new questionnaire for incontinence: The International Consultation on Incontinence Questionnaire (ICIQ). Neurourol Urodyn. 2001;20(4):510-1.
18. Tamanini JTN, Dambros M, D'Ancona CAL, Palma PCR, Netto NR Jr. Validation of the "International Consultation on Incontinence Questionnaire – Short Form" (ICIQ-SF) for Portuguese. Rev Saude Publica. 2004;38(3):438-44. doi: 10.1590/s0034-89102004000300015.
19. Klovning A, Avery K, Sandvik H, Hunskaar S. Comparison of two questionnaires for assessing the severity of urinary incontinence: the ICIQ-UI SF versus the incontinence severity index. Neurourol Urodyn. 2009;28(5):411-5. doi: 10.1002/nau.20674.
20. Bø K, Sherburn M. Evaluation of female pelvic-floor muscle function and strength. Phys Ther. 2005;85(3):269-82.
21. Botelho S, Pereira LC, Marques J, Lanza AH, Amorim CF, Palma P, et al. Is there correlation between electromyography and digital palpation as means of measuring pelvic floor muscle contractility in nulliparous, pregnant, and postpartum women? Neurourol Urodyn. 2013;32(5):420-3. doi: 10.1002/nau.22321.
22. Kubota A, Sakuraba K, Araki K, Ishizuka T, Nakaniida A, Suzuki Y. Effects of a facilitating device on pelvic floor muscle contraction during breathing exercises. J Phys Ther Sci. 2018;30(12):1468-72. doi: 10.1589/jpts.30.1468.
23. Mateus-Vasconcelos ECL, Brito LGO, Driusso P, Silva TD, Antônio FI, Ferreira CHJ. Effects of three interventions in facilitating voluntary pelvic floor muscle contraction in women: a randomized controlled trial. Braz J Phys Ther. 2018;22(5):391-9. doi: 10.1016/j.bjpt.2017.12.006.
24. Messelink B, Benson T, Berghmans B, Bø K, Corcos J, Fowler C, et al. Standardization of terminology of pelvic floor muscle function and dysfunction: report from the pelvic floor clinical assessment group of the International Continence Society. Neurourol Urodyn. 2005;24(4):374-80. doi: 10.1002/nau.20144.
25. Mateus-Vasconcelos ECL, Ribeiro AM, Antônio FI, Brito LGO, Ferreira CHJ. Physiotherapy methods to facilitate pelvic floor muscle contraction: a systematic review. Physiother Theory Pract. 2018;34(6):420-32. doi: 10.1080/09593985.2017.1419520.
26. Pinheiro BF, Franco GR, Feitosa SM, Yuaso DR, Castro RA, Girão MJBC. Fisioterapia para consciência perineal: uma comparação entre as cinesioterapias com toque digital e com auxílio do biofeedback. Fisioter Mov. 2012;25(3):639-48. doi: 10.1590/S0103-51502012000300019.
27. Bø K. Pelvic floor muscle strength and response to pelvic floor muscle training for stress urinary incontinence. Neurourol Urodyn. 2003;22(7):654-8. doi: 10.1002/nau.10153.
28. Neumann PB, Grimmer KA, Deenadayalan Y. Pelvic floor muscle training and adjunctive therapies for the treatment of stress urinary incontinence in women: a systematic review. BMC Womens Health. 2006;6:11. doi: 10.1186/1472-6874-6-11.

29. Lauper M, Kuhn A, Gerber R, Luginbühl H, Radlinger L. Pelvic floor stimulation: what are the good vibrations? Neurourol Urodyn. 2009;28(5):405-10. doi: 10.1002/nau.20669.

30. Bø K, Finckenhagen HB. Is there any difference in measurement of pelvic floor muscle strength in supine and standing position? Acta Obstet Gynecol Scand. 2003;82(12):1120-4. doi: 10.1046/j.1600-0412.2003.00240.x.

31. Chmielewska D, Stania M, Sobota G, Kwaśna K, Błaszczak E, Taradaj J, et al. Impact of different body positions on bioelectrical activity of the pelvic floor muscles in nulliparous continent women. Biomed Res Int. 2015;2015:905897. doi: 10.1155/2015/905897.

32. Frawley HC, Galea MP, Phillips BA, Sherburn M, Bø K. Effect of test position on pelvic floor muscle assessment. Int Urogynecol J Pelvic Floor Dysfunct. 2006;17(4):365-71. doi: 10.1007/s00192-005-0016-3.

33. Sapsford RR, Richardson CA, Stanton WR. Sitting posture affects pelvic floor muscle activity in parous women: an observational study. Aust J Physiother. 2006;52(3):219-22. doi: 10.1016/s0004-9514(06)70031-9.