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Research Article

Effect of Passive Vaginal Electrical Stimulation and Home Pelvic Floor Muscle Training on the Stress Component of Female Urinary Incontinence

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Abstract

Introduction

Pelvic floor physiotherapy is indicated as the first-line treatment for urinary incontinence. The aim of this study was to evaluate the effect of passive vaginal electrical stimulation and home pelvic floor muscle training on the stress component of female urinary incontinence.

Material and Methods

A prospective study was conducted comparing each patient as their own control before and after treatment, randomly assigned by medical file number. Out-patients from the Urogynecologic and Vaginal Surgery Clinic of a Medical School were assessed and 33 women with stress or mixed urinary incontinence completed the study. The intervention protocol was performed on 12 weekly sessions for 3 months. The first and 12th sessions were dedicated to evaluations and orientations; 10 sessions of pas-

sive vaginal electrical stimulation were given. Exercises were learned during the first session for performance at home. The sample size was calculated as 32 patients with a power of 80% and significance of 5%. Wilcoxon and McNemar tests were used to compare results.

Results

33 women, 7 with stress urinary incontinence and 26 with mixed urinary incontinence, were studied. There was a significant reduction in the number of episodes of urinary incontinence and improvements in pelvic floor muscle activity and quality of life, although results on the pad test did not reach significance.

Conclusions: the protocol of passive electrical stimulation in combination with pelvic floor muscle training at home proved effective for improving the stress component of urinary incontinence and should be included as part of routine treatment of women with pelvic floor dysfunction.

Keywords: Electric Stimulation; Pelvic Floor; Urinary Incontinence; Stress; Female

Introduction

Urinary incontinence is defined as any involuntary loss of urine. Most commonly, the loss during stress situations such as coughing, sneezing, laughing or jumping, is called stress urinary incontinence (SUI) [1,2]. When SUI is associated with urgency symptoms it is referred to as mixed urinary incontinence (MUI), and has a high prevalence among women of all ages, but is especially common in the climacteric period [3].

Age, weight, hormonal status, parity, pelvic floor trauma, constipation and intense physical exercise are the major risk factors for developing urinary incontinence [2-5].

Pelvic floor physiotherapy is indicated as the first-line treatment for urinary incontinence. Cure or improvement (50% to 97%) depend on the severity of the symptoms and on the protocol employed [6-11].

Pelvic floor muscle training, vaginal weights, vaginal electrical stimulation, behavior education and bladder training are commonly used to treat incontinence [8,12-15].

Improvement in urinary frequency and urine loss can be explained by the Integral Theory of Petros of 2007 [6]. The lack of muscular support due to hypotonia of the PFM places the opening of the suburethral angle and residual urine into contact with the receptors located at this site, triggering stimuli to the pontine center, thereby activating the micturition reflex. Unable to squeeze the sphincter closed against the pressure exerted on it, the PFM allow urine to escape. Thus, activation of the PFM provides the support needed to revert the stimulus created, delaying urination until a convenient time.

Vaginal electrical stimulation on the other hand, by recruiting a greater quantity of motor units, promotes improved muscle function acting as "biofeedback" through electrical stimuli, recommended in the treatment of the stress component of urinary incontinence.

The objective was to evaluate the effect of passive vaginal electrical stimulation and home pelvic floor muscle training on the stress component of female urinary incontinence.

Material and Methods

This prospective study was carried out from 2012 to 2013 and involved 33 urinary incontinent outpatients from the Clinic of Urogynecology and Vaginal Surgery, Department of Obstetrics and Gynecology of Santa Casa de São Paulo Medical School, Brazil.

All patients signed an informed consent form in accordance with the Research Ethics Committee of the Institution, registered on Plataforma Brasil under registration no. CAEE 137162132.00005479 and approved by ethical committee in humans research from Santa Casa de São Paulo Medical School, Brazil.

The inclusion criteria were women with SUI or MUI, aged from 35 to 55 years old. The exclusion criteria were stress urinary incontinence due to sphincter deficiency (VLPP<60cmH_2O), urge incontinence alone, rectal prolapse, pelvic organ prolapse of third-degree or greater, according to the POP-Q, pregnancy or post parturition, malignant tumors, neuropathies, myopathies, urinary tract obstruction or infection, genital infection, previous pelvic irradiation, established heart disease, metallic prosthesis, psychiatric illness, cognitive impairment, and illiteracy.

After gynecologic examination and urodynamic study, patients answered the ICIQ-SF [16] questionnaire, the visual analog scale [17], received a function diary to complete at home and performed the pad test [18,19]. The bi-digital test for pelvic floor muscle (PFM) contraction was applied according to the Modified Oxford Scale (MOS: 0=nil, 1=flicker, 2=weak, 3=medium, 4=strong, 5=very strong) [20], with contraction defined as the capacity to squeeze and lift the PFM. Hypocontractile PFM was considered as MOS ≤3, and four specific areas were evaluated: anterior and posterior, left and right. Any asymmetry of mass, tonus, or action was recorded and all tests were repeated after treatment. Patients were treated in the lithotomy position with the back rest set at 45° and pelvis in a neutral position, legs flexed and slightly abducted, with feet on the table as previously described elsewhere by other authors.

The protocol was designed to treat only the pelvic floor sup-

port muscles, where urgency symptoms were to be treated afterwards. The PF physiotherapy protocol used as standard at the clinic was performed over 12 individual sessions, with the first and last sessions dedicated only to tests and exercise orientations. Passive vaginal electrical stimulation was applied a total of 10 times, once a week. The electrode was placed on the posterior wall of the vagina, corresponding to the 6 o'clock position, where it was kept by the physiotherapist for 20 minutes.

Electrical stimulation parameters: for the five first sessions, parameters used were F 35Hz and T 500μs. Subsequent sessions were performed at F 50Hz and T 700μs. Intensity (mA) was adjusted to a sub-maximal and tolerated motor level that induced no pain. Contractions were sustained for five seconds followed by 10 seconds of rest. To train endurance, patients were stimulated to progressively contract for up to 10 seconds, followed by one minute´s rest, repeated five times. Fast activity was trained by applying three series of ten contractions, each sustained for two seconds followed by two seconds´ rest, and the ramp was adjusted to 0.5. One minute of rest was allowed between the series. A complete session of treatment lasted up to 40 minutes.

All patients were instructed to perform pelvic floor muscle exercises at home, once a day. During the fifth session, patients learned endurance exercises using a vaginal tampon: subjects had to contract their muscles while pulling out the string in different directions so as to attain symmetry and endurance: 10 contractions of five seconds each were performed, with 10 seconds of rest between sets.

The Wilcoxon test was used to compare clinical data before and after treatment: Manual test, Pad test results, Function diary, ICIQ-short form, and Visual analog scales. The McNemar test was employed to compare asymmetric muscle activity, command reversal and coitus urinary incontinence. A value of P≤0.05 was considered statistically significant [21].

Results

It was included 33 women in this study, seven (21.2%) had a diagnosis of SUI and 26 (78.8%) MUI. Considering the risk factors to develop urinary incontinence and variables related to the condition, table 1 represents women anthropometric, obstetrics and lifestyle characteristics. Most of them were physical active (66.7%) and on menopause stage (75.8%). The mean of parity was 3 (SD 1.6) and at least 27 (81%) had experienced vaginal birth, also 10 (30.3%) women had combined situation with vaginal birth and caesarian surgery.

There were a significant difference before and after treatment comparing function diary (FD) scores associated to urinary frequency reduction, increase on manual test score and decrease on perceived volume of urine loss evaluated by VAS1 (Table 2).

Quality of life was measured by ICIQ-SF and women perceived quality of life in relation to her episodes of urinary incontinence (VAS 2), both of them presented lower index indicating increase in quality of life parameters comparing before and after intervention protocol (Table 3).

Table 1. Anthropometric, obstetrics and lifestyle characteristics of women with urinary incontinence included on this study (n=33).

Variable	Mean	SD
Age	45.82	6.39
BMI	28.29	3.96
Sexual Activity	8	24.2
Previous Pelvic Surgery	11	33.3
Menopause	25	75.8
Smoking	7	21.2
Physical Activity	22	66.7
Variable	n	%
Parity		
Nuliparous	1	3.0
Primiparous	6	18.1
Multiparous	26	78.7
At least one episode of Vaginal Birth	27	81.8
At least one episode of Caesarian Surgery	15	45.4

BMI: Body Mass Index; N: Total number of patients; SD: Standard Deviation

Table 2. Comparisons of function diary (FD) scores before and after treatment for the variables UF: Urinary frequency; ULE: urinary loss episodes; and Pad Test, of patients treated at the Pelvic Physiotherapy Center of DOGI – ISCMSP.

Variable		Before Treatment	After Treatment	Wilcoxon (p)
FD- UF	Mean	7.90	6.11	0.001*
	Median	7.00	6.00	
	SD	2.91	2.22	
	N	33	33	
FD- ULE	Mean	3.93	1.93	<0.001*
	Median	2.66	0.66	
	SD	4.65	3.37	
	N	33	33	

PAD TEST (1h.)	Mean	7.61	6.27	0.782
	Median	2.00	1.00	
	SD	12.41	9.34	
	N	33	33	
MT	Mean	1.45	3.39	<0.001*
	Median	1.00	4.00	
	SD	0.62	0.90	
	N	33	33	
VAS 1	Mean	6.39	3.58	<0.001*
	Median	7.00	3.00	
	SD	2.74	3.31	
	N	33	33	

FD: function diary; UF: urinary frequency; ULE: urinary loss episodes; h: hours; Pad Test: Tampon Test; MT: Manual Test; VAS 1: Perceived volume of urine loss; *: Significant; SD: Standard Deviation.

Table 3. Perceived general quality of life in relation to urinary incontinence (VAS 2) and quality of life questionnaire – ICIQ-SF. Comparison of patients, before and after treatment.

Variable		Before treatment	After Treatment	Wilcoxon (p)
VAS 2	Mean	7.73	3.24	<0.001*
	Median	8.00	2.00	
	SD	2.35	3.23	
	N	33	33	
ICIQ -SF	Mean	13.45	6.79	
	Median	15.00	6.00	
	SD	4.04	5.73	
	N	33	33	

VAS 2: Perceived quality of life in relation to urinary incontinence; *: Significant; ICIQ-SF: Quality of life questionnaire for stress urinary incontinence; SD: Standard Deviation.

Discussion

The initial goal of the study was to recruit women with a diagnosis of SUI alone. However, this proved unfeasible given the high prevalence of cases diagnosed with MUI. Consequently, it was decided to study the stress component. The study sample was consistent with those reported in the literature, having a high prevalence of MUI and also an age range of 33-55 years, mirroring the population-based studies of Tennstedt et al. [3] cited in the Introduction section of this paper.

According to Guarisi et al. [22], UI occurs in 30% to 60% of women during the climacteric stage and menopause. In this study, 22 (66.7%) patients were not menopausal but at the climacteric stage. This predisposes these women to fluctuations in hormone levels which, concomitant with parity, vaginal birth and overweight status (Table 2), create conditions conducive to the risk factors for urinary incontinence, as outlined by Guarisi et al. [22], Palma [23]; Higa et al. [4], Marques and Ferreira [5].

With regard to the "cough" risk factor, only seven patients reported being smokers and chronic coughers, and this did not represent a determining factor for urine loss in this group of women. However, in relation to activities of daily living such as sitting, getting up, climbing up and down stairs, walking, carrying loads or practicing physical exercise, both coughing and sneezing were identified as triggers for urine loss. These situations can facilitate urine loss when pelvic floor muscles (PFM) prove unable to seal the urethra, as pointed out by Higa et al. [4], Marques and Ferreira [5]. Thus, the protocol adopted included functional PFM exercises promoting improvement in stress urinary incontinence symptoms.

The voiding diary allows patients to record their urinary frequency and episodes of urine loss providing key information to help practitioners orient patients on urinary habits and water intake. The Pad Test (Table 2) yielded no significant results. However, it is noteworthy that patients reported urine loss within an hour of completing the test, after having left the service. This prompted a reassessment of the specific conditions under which women have urine loss, calling for a greater emphasis on training of PFM in dynamic situations.

According to the results of the manual test (Table 2), a significant improvement in PFM function was evident, as previously demonstrated by other authors [8]. On the assessment, all patients exhibited muscle asymmetry and also command inversion, both of which were corrected after the treatment.

The conducting of the manual test by a specialized physiotherapist was deemed important both for the initial assessment and during treatment.

In our clinical experience, fine details can be detected using the manual test such as asymmetry in mass and muscle tonus, command inversion, hypotonia and/or hypertonia of muscle bundles, uncoordinated movement, with the test being essential for monitoring the training of the PFM in a functional manner.

Based on clinical experience, the uniform and symmetric contraction activity of the PFM is a major indicator of physiotherapy treatment success.

During the assessment, all patients were found to be largely

unfamiliar with their genital region, muscles and functions, showing some difficulty in understanding and performing the muscle contractions. This finding was mentioned by Latorre [24], who stated that one third of Western women are unfamiliar with this region of their body. We noted that the manual test using digital touch promoted proprioception by acting as "biofeedback". In the present study, only one out of the 33 women assessed was unable to learn the active muscle contractions, despite the use of a number of different verbal prompts and stimuli. Nevertheless, the patient showed improvement in stress urinary incontinence symptoms.

No standards are available in the literature on the optimal approach for training PFM [25,26], the ideal number of daily repetitions, time interval between contractions, correct physical posture or the appropriate intensity of muscle stress.

A feature differentiating the protocol employed was the use of intracavity devices for endurance exercises. These assisted and supplemented the muscle training, improved perception and performance, while allowing the activation of muscle bundles in a coordinated and symmetric fashion.

Passive vaginal electrical stimulation proved effective for recruiting motor units which facilitated contractions, in contrast to Bo et al. [7] who stated that electrostimulation was less effective.

In addition, passive vaginal electrostimulation is practical for application in patients suffering orthopedic problems, with joint limitations and pain.

As outlined in the methods section, electrical stimulation was applied on a weekly basis throughout all sessions, as proposed by Gomes et al. [26].

Akin to PFM training, a lack of consensus on the ideal vaginal electrostimulation protocol was evident from the early publications of Caldwell (1963) through to more recent reports by Santos et al. [15], Correia et al. [27], and Ferreira et al. [28].

The results of the literature search revealed a similar lack of standardization of the methods for physiotherapy assessment, with significant variations in the manual test, Pad Test and Quality of Life Questionnaires, hampering comparison of results and analysis of improvements or remission of stress urinary incontinence. By contrast, the present study described the model of device used, the type of electrode and its placement, the electrical parameters such as frequency, pulse width and intensity employed for all the sessions, as well as the frequency that patients underwent sessions.

According to Petros and Skilling [12], Bo and Sherbum [8], Dumoulin and Hay Smith [14], and to Etienne [29] it is crucial that the protocols used in pelvic physiotherapy are rigorously described in scientific studies, including the exact program planned for each treatment as well as the modality of application and outcomes, to allow meaningful analyses and comparisons.

It is also important to mention the existence of restrictions on pelvic physiotherapy treatment under the Brazilian Unified Health System (SUS), representing a serious obstacle precluding patient access to treatment.

Although accessible in the host institution (ISCMSP), the number of places available for treatment is insufficient, while there is also a shortage of specialists.

Coital urinary incontinence was another complaint reported by the patients studied. Of the total patients assessed, 14 sexually active women had this complaint. Shaw [30] reported that this symptom is more common in women younger than 50 years of age.

Disparities in opinion on coital UI are also found: Clark and Romm [31] reported no difference between types of incontinence, concluding that women with SUI or MUI were equally prone to urine loss at any phase of sexual response. However, Hilton [32] claimed that women with SUI tended to suffer urine loss during the penetration phase whereas those with MUI had leakage during orgasm. According to observations in the present assessments, patients were unable to identify at which phase of sexual response urine loss occurred, irrespective of type of UI.

Moreover, coital UI was linked to sexual performance of these women, directly impacting their libido, exacerbating their embarrassment and impairing their quality of life. According to Haylen et al. [2], exploring this symptom is always necessary and recommended.

Guarisi et al. [22], affirmed that UI directly influenced the daily activities of incontinent women to the extent that they had lower quality of life scores. This finding was corroborated by the present study which observed impaired QoL at baseline evaluation followed by enhanced QoL at the end of treatment.

Similarly, Tamanini et al. [16], held that objective parameters such as the Urodynamic study, Pad Test, and other clinical measures fail to analyze the way UI influences the lives of women. These shortcomings prompted the devising of specific quality of life questionnaires such as the ICIQ-SF. We are in agreement with the authors in as much as the way women leak urine serves as a guide for devising a suitable treatment plan. Women often experienced urine leakage in specific everyday situations, yet this is not replicated in all situations, being dependent on the volume stored, body position and degree of fatigue at the time.

Taken together, the results of our study showed the protocol based on pelvic floor muscle training and passive vaginal electrical stimulation to be effective and applicable in routine clinical practice.

Conclusion

The significant results of this study allow us to conclude that pelvic floor muscle training and passive vaginal electrical stimulation are effective in the treatment of the stress component of female urinary incontinence.

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