Original Article

Comparison of three different pelvic floor muscle training protocols for treating lower urinary tract symptoms due to Multiple Sclerosis: A Clinical Trial

Comparação de três diferentes protocolos de treinamento dos músculos do assoalho pélvico para o tratamento de sintomas do trato urinário inferior decorrentes da esclerose múltipla: um ensaio clínico

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ABSTRACT

Background: Lower urinary tract symptoms (LUTS) are common in women with multiple sclerosis. Objective: To investigate the effects of pelvic floor strengthening programs associated with different neuromuscular electrostimulation protocols on urinary symptoms in women with MS. Methods: Forty-one women with relapsing-remitting multiple sclerosis were enrolled in this study. Participants were divided into three groups. G1= Transcutaneous Tibial Nerve Stimulation (TTES) combined with Pelvic Floor Muscle Training (PFMT);G2= intravaginal electrical stimulation with PFMT and G3 PFMT alone. Assessments involved the Expanded Disability Status Scale score, the NEW PERFECT scheme, and Overactive Bladder Questionnaire (OABv8), and the Qualiveen Questionnaire. Statistical procedures involved Shapiro-Wilk test, Age and EDSS were evaluated using one-way ANOVA. Results: The groups were similar in terms of sample size, age, and disease severity. (p >0,05). There was an oscillation with improvement in both groups where there was stimulation association ($P = 0.001$; $\eta 2p = 0.748$). However, participants who experienced significant improvement were those who underwent intravaginal electrical stimulation associated with TMAP ($P = 0.001$; $\eta 2p = 0.571$). Conclusion: Pelvic Floor Muscle Training associated with intravaginal neuromuscular stimulation potentiates the reduction of lower urinary tract symptoms and increases the contractility of pelvic floor muscles (both fast and slow fibers) compared with other physical therapy modalities.

Keywords: Keywords: Multiple sclerosis; lower urinary tract symptoms; pelvic floor; quality of life; sexuality.

RESUMO

Introdução: Contexto: Os sintomas do trato urinário inferior (LUTS) são comuns em mulheres com esclerose múltipla. Objetivo: Investigar os efeitos dos programas de fortalecimento do assoalho pélvico associados a diferentes protocolos de eletroestimulação neuromuscular nos sintomas urinários em mulheres com EM. Métodos: Quarenta e uma mulheres com esclerose múltipla recorrente-remitente foram envolvidas neste estudo. As participantes foram divididas em três grupos. G1 = Estimulação transcutânea do nervo tibial (ETT) combinada com treinamento dos músculos do assoalho pélvico (PFMT); G2 = estimulação elétrica intravaginal com PFMT; e G3 PFMT. As avaliações envolveram a pontuação da Escala Expandida de Status de Incapacidade, o esquema NEW PERFECT e o Questionário de Bexiga Hiperativa (OABv8. Os procedimentos estatísticos envolveram o teste de Shapiro-Wilk, a idade e o EDSS foram avaliados usando ANOVA unidirecional. Resultados: Os grupos foram semelhantes em termos de tamanho da amostra, idade e gravidade da doença. (p > 0,05). Houve uma oscilação com melhora em ambos os grupos onde houve associação de estimulação ($P = 0,001$; $\eta 2p = 0,748$). No entanto, os participantes que apresentaram melhora significativa foram aqueles que passaram por estimulação elétrica intravaginal associada ao TMAP ($P = 0,001$; $\eta 2p = 0,571$). Conclusão: O treinamento muscular do assoalho pélvico associado à estimulação neuromuscular intravaginal potencializa a redução dos sintomas do trato urinário inferior e aumenta a contratilidade dos músculos do assoalho pélvico (fibras rápidas e lentas) em comparação com outras modalidades de fisioterapia.

Palavras-chave: Esclerose múltipla; sintomas do trato urinário inferior; assoalho pélvico; qualidade de vida; sexualidade.

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INTRODUCTION

Multiple Sclerosis (MS) is the most common demyelinating disease, characterized by being chronic, autoimmune, inflammatory, and demyelinating, causing injury to the white matter of the Central Nervous System (CNS)[1].

These lesions cause intermittent neurological signs and symptoms which, with disease progression, can worsen progressively. Although the axon is preserved, destruction of the myelin typically results in altered nerve impulse conduction[2].

Most patients develop some form of lower urinary tract dysfunction due to alterations in the connection between the brainstem and the spinal cord. The demyelination process affects the lateral corticospinal tract and the reticulospinal pathway, making micturition and sphincter dysfunctions common[2,3]. Lower Urinary Tract Symptoms (LUTS) in women with multiple sclerosis significantly impact their quality of life, directly affecting social, occupational, and domestic activities, negatively interfering with emotional state and sexual life[3,4].

Given this scenario, the development of therapies aimed at alleviating such symptoms and ensuring quality of life for the population is evident. Antimuscarinic agents constitute the first-line pharmacological treatment for neurogenic overactive bladder. However, these medications can cause adverse effects such as dry mouth, constipation, dizziness, and blurred vision, often leading to treatment discontinuation[4].

According to the International Continence Society (ICS), the first-line treatment for UI is Pelvic Floor Muscle Training (PFMT) either alone or combined with other muscle recruitment techniques such as electrical stimulation[5]. PFMT, also known as Kegel exercises, introduced in 1948 primarily for stress urinary incontinence, has shown remarkable results for controlling overactive bladder in people with MS[6].

Although the mechanisms underlying the reduction of symptoms through pelvic exercises are vague, it is presumed that the contraction of the pelvic floor musculature is related to the activation of the perineo-detrusor reflex, where perineal contraction promotes reflex relaxation of the detrusor muscle[7].

Electrical stimulation is a therapeutic approach that presents few side effects and has been studied for lower urinary tract symptoms (LUTS)[5,6]. It is believed that in the face of the uninhibited contraction of the detrusor muscle, low-frequency electrical currents emitted through the pudendal nerve promote the inhibition of parasympathetic stimuli, regulating the lack of suppression of the primitive micturition reflex and consequently involuntary urge to urinate. Electrical stimulation can be applied with self-adhesive electrodes on the skin surface over muscles or nerves or intracavitary (intravaginal or endorectal).

Transcutaneous Tibial Electrical Stimulation (TTES) and Intravaginal Pelvic Floor Electrical Stimulation are the most common options for electrotherapy in the treatment of overactive bladder, being non-invasive and presenting fewer side effects compared to drugs and antimuscarinics[8].

Intravaginal Pelvic Floor Electrical Stimulation (IPFES) has the advantage of being applied directly to the target muscles of treatment, aiming to promote direct recruitment of phasic and tonic fibers of the pubovaginal, anal sphincter, and transverse perineal muscles, increasing proprioception of the periurethral region and stimulating the perineal branches of the pudendal nerve[9].

TTES is more comfortable and less embarrassing for the patient compared to IPFES. The tibial nerve is a mixed nerve containing fibers from L4-S3 which have the same spinal segments as the innervations for the bladder and pelvic floor. TTES inhibits bladder overactivity by depolarizing the somatic afferent fibers of the lumbar and sacral nerves[10,11].

Given this scenario, it is of paramount importance to conduct research on the development of specific treatment protocols to alleviate such symptoms and ensure quality of life for the population with MS. Therefore, we investigated the effects of pelvic floor strengthening programs associated with different neuromuscular electrostimulation protocols on urinary symptoms in women with MS.

METHODS

To achieve the objectives, a prospective study was undertaken of the clinical trial with women with MS with lower urinary tract symptoms (LUTS).

Ethical approval was obtained from the institutional ethics committee under protocol number 5.504.979. The project has also been submitted and approved by the Brazilian Clinical Trials Registry (ReBEC) under registration number RBR-29fy354.

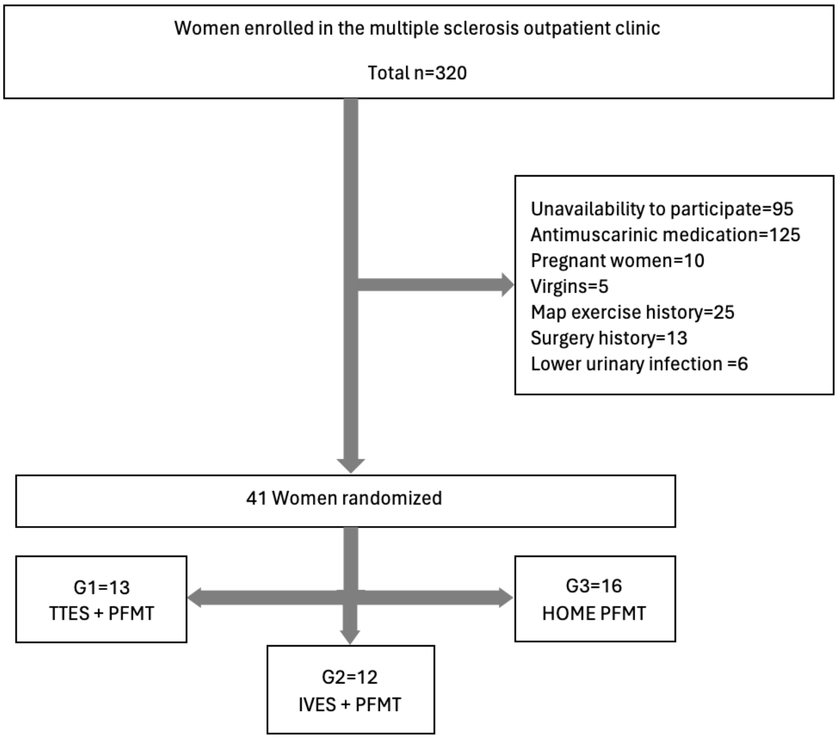
The inclusion criteria involved women with relapsing-remitting multiple sclerosis diagnosed according to the Macdonald classification (Thompson et al., 2017), aged over 18 years, in the early or moderate stages of the disease (score lower than

6 on the Expanded Disability Status Scale), and experiencing at least three lower urinary tract symptoms (urgency, urge urinary incontinence, elevated urinary frequency, nocturia, and nocturnal enuresis) for at least six months. The exclusion criteria included the use of antimuscarinic medication, presence of genital prolapse, lower urinary tract infection, previous history of pelvic floor exercises, pelvic or abdominal surgery, being virgins or pregnant. Patients in the acute phase of the disease were also excluded.

Os autores conducted a sample size calculation before recruiting participants. Using the GPower® program and assuming an alpha error of 5%, power of 80%, and effect size of 0.394 (Ferreira et al., 2016), we found the need for a minimum of 37 women.

The sample size calculation guided subject recruitment. All participants were selected from the Multiple Sclerosis Outpatient Clinic at the Maria Aparecida Pedrossian University Hospital of the Federal University of Mato Grosso do Sul (HUMAP/UFMS) in the years 2022 and 2024 based on the inclusion criteria. Participants were invited and informed that in order to participate in the study they would need to go to the Outpatient Clinic twice a week for a period of six months. Then, those who accepted and gave their formal signed consent were divided into three groups using opaque envelopes. The evaluators were blinded to the group assignment to which each patient would belong. There was no possibility of blinding the researcher who performed the interventions. The flowchart of this study demonstrates the recruitment and exclusion of participants.

Figure 01. Study design flowchart



THERAPEUTIC PROTOCOLS

The research design involved 41 participants divided into three independent groups: Group G1 consisted of 13 participants undergoing Transcutaneous Tibial Nerve Stimulation (TTES) combined with Pelvic Floor Muscle Training (PFMT); Group G2 comprised 12 participants undergoing Intravaginal Electrical Stimulation (IVES) combined with PFMT; and Group G3 consisted of 16 participants undergoing PFMT alone, conducted at home without direct supervision from the physiotherapist. However, the physiotherapist contacted the participants in Group G3 weekly to maintain their adherence to the home exercise programs.

All groups underwent twelve weeks of treatment, with 24 physiotherapy sessions, twice a week, over a period of six months, under the guidance of a physiotherapist with expertise in pelvic rehabilitation.

Transcutaneous Tibial Nerve Stimulation therapy was applied with the patient in supine position, lower limbs extended. The self-adhesive electrodes were applied 5 cm and 10 cm above the medial malleolus and connected to the stimulation equipment (Dualpex 961Uro, Quark Medical Products, Brazil). TTES was performed twice a week, with a therapy time of 30 minutes, frequency of 2Hz, positive pulse duration of 1ms, symmetric biphasic pulse wave could be provided in a range of 1 to 100 mA (based on patient discomfort feedback), and the intensity tolerated by the patient ranged between 35mA and 65mA[10,11].

Intravaginal Electrical Stimulation (IVES) therapy was administered with the patient in lithotomy position using a stimulation device (Dualpex 961Uro, Quark Medical Products, Brazil) with a vaginal probe. IVES was performed twice a week, with a therapy time of 30 minutes, frequency of 2Hz, positive pulse duration of 1ms, symmetric biphasic pulse wave could be provided in a range of 1 to 100 mA (based on patient discomfort feedback), and the intensity tolerated by the patient ranged between 35mA and 65mA[12].

The Pelvic Floor Training Protocol was based on the protocol by Ferreira, AP et al, 2016. It consisted of 3 sets of 20 rapid contractions (2 seconds of contraction and 10 seconds of relaxation) and 20 slow contractions (10 seconds of contraction and 20 seconds of relaxation) in 3 different positions:

1. Bridge: Supine position with the upper limbs extended alongside the body and the knees and hips flexed, feet supported on the ground, on a mat. Begin by inhaling and relaxing the pelvic floor; then, during exhalation, elevate the hips and contract the pelvic floor muscles; slowly return to the initial position.
2. Hip Rotation: Participant seated with lower limbs extended, ankles plantarflexed, hip externally rotated; inhale with relaxed pelvic floor; then, during exhalation, internally rotate the lower limbs so that the toes are pointing inward; contract the pelvic floor muscles; return to the initial position.
3. Standing: Orthostatic position with lower limbs hip-width apart; initially perform plantar flexion (raise onto the toes); inhale with relaxed pelvic floor, then perform a slight squat during exhalation; contract the pelvic floor muscles; return to the initial position.

ASSESSMENT PROCEDURES

The assessments initially involved a sociodemographic questionnaire, administered to both groups. Then, using the Expanded Disability Status Scale, a neurologist specializing in MS disorders evaluated the severity of the disease for each participant[13].

The Overactive Bladder Questionnaire OAB-V8 was used to classify the LUTS of the participants. This instrument assesses the following urinary symptoms: daily urinary frequency, urinary urgency, urge urinary incontinence, nocturia, and nocturnal enuresis. The total score of the instrument ranges from zero to forty, with scores higher than eight indicating a diagnosis of LUTS[14].

The evaluation of pelvic floor muscle and urinary symptoms were outcome variables in this study. The assessment of pelvic floor muscle was classified using the NEW PERFECT scheme[15]. For the NEW PERFECT scheme, participants remained in a supine position with hips and knees semi-flexed. A physiotherapist specializing in urogynecological disorders conducted the test, carefully inserting the index and middle fingers into the patient's vaginal canal. The variables assessed with the NEW PERFECT scheme were: contraction power (pts), endurance (sec), number of repetitions (n), number of rapid contractions (n), elevation of the vaginal wall during maximum contraction (yes/no), co-contraction (yes/no), and cough time (yes/no). In the NEW PERFECT scheme, higher values represent better pelvic floor muscle strength[15].

STATISTICAL ANALYSIS

The data analysis involved descriptive and inferential statistics. Initially, normality analysis was performed using the Shapiro-Wilk test. Data showing parametric patterns were described as mean ± standard deviation to characterize the data. The comparison of sample size was conducted using the chi-square test. Age and EDSS were evaluated using one-way ANOVA. The effects of therapies on OAB-V8 were assessed using the Analysis of Variance for Repeated Measures. Significance was set at 5%, and effect size (η^2p) was reported when significant differences between groups were observed.

RESULTS

In the present study, 41 women participated, with 13 in Group G1 (TTES), 12 in G2 (IVES), and 16 in G3 (control group). The groups were Yesilar in terms of sample size, age, and disease severity. The mean age of the groups was 33.4 years for G1. 41.7 years for G2 and 36.9 years for G3. Regarding the severity of MS measured by EDSS, the mean scores were 3.7 for G1. 3.5 for G2 and 4.0 for G3. Refer to Table 1 for details.

Table 1. Aspects of the physical examination of the participants in three groups.

Variable		**G1**	**G2**	**G3**	**P**
Sample size (n)		13	12	16	0.728
Age (years)		33.4 (9.2)	41.7 (11.4)	36.9 (11.4)	0.172
EDSS (points)		3.7 (1.7)	3.5 (0.8)	4.0 (1.7)	0.573
Perineal sensitivity	Normal	12	11	14	0.595
	Medium	1	1	1	
	Severe	1	1	1	
Anal cutaneous reflex	Present	9	9	12	0.232
	Absent	4	3	4	
Genital dystopia	Yes	0	0	0	0.999
	No	13	12	16	
Voluntary contraction	Yes	14	14	15	0.309
	No	1	1	1	
Stress urinary incontinence test	Yes	0	0	0	0.999
	No	13	12	16	

Legend: G1: Transcutaneous tibial electrostimulation associated with pelvic floor muscle training; G2: Intravaginal electrostimulation associated with pelvic floor muscle training; G3: Pelvic floor muscle training; EDSS: Expanded Disease Disability Scale. Age and EDSS are presented as mean ± standard deviation, and inferential analysis was performed using independent t-test. Sample size, gender, perineal sensitivity, and anal cutaneous reflex are presented as case numbers, and inferential analysis was performed using cross-tab chi-square test.

Table 2. Initial and final results of the participants contraction of the perineal musculature in three groups.

Analysis of the Perfect scheme	**Groups**	**Moment**		p^b
		Initial	**Final**	
Contraction strength (Oxford grade)	G1	2.0±2.0	3.0±1.0	0.069
	G2	2.0±2.0	3.0±1.0	0.069
	G3	2.0±2.0	2.0±1.0	0.998
	p^a	0.549	0.642	
Endurance (seconds)	G1	5.0±4.0	5.0±8.0	0.109
	G2	3.0±0.7	3.0±8.0	0.107
	G3	4.0±0.7	4.9±1.0	0.358
	p^a	0.130	0.072	
Number of slow repetitions (n)	G1	5.0±1.5	5.0±2.0	0.639
	G2	5.0±0.0	7.0±0.0	***0.059***
	G3	5.0±1.5	5.0±2.0	0.639
	p^a	0.213	0.025	
Number of fast repetitions (n)	G1	5.0±1.0	5.0±1.5	0.317
	G2	6.0±3.5	7.5±5.0	**0.042**
	G3	6.0±3.5	6.5±5.0	0.642
	p^a	0.156	0.098	

Legend: The variables of the Perfect scheme are presented as median ± interquartile range, and inferential analysis was conducted using the Mann-Whitney U test (pa) and Wilcoxon (pb).

In the present study, using the OAB-V8 tool to measure urinary symptoms, participants in Group G1 had a mean score of 24.1 ± 7.4 at the beginning of the treatment, which decreased to 13.3 ± 5.7 at the end of the 12-week period. Group G2 showed scores of 25.4 ± 8.8 at the beginning of the treatment, significantly decreasing to 3.3 ± 4.1 at the end. On the other hand, Group G3 had a mean score of 26.7 ± 7.1 before treatment, which remained at 24.0 ± 7.1 after treatment.

Women undergoing only home-based TMAP did not experience significant improvement in these symptoms. The groups showed different patterns in the OAB-V8 questionnaire ($P = 0.001$; $\eta 2p = 0.393$). There was an oscillation with improvement in both groups where there was stimulation association ($P = 0.001$; $\eta 2p = 0.748$). However, participants who experienced significant improvement were those who underwent intravaginal electrical stimulation associated with TMAP ($P = 0.001$; $\eta 2p = 0.571$). The group with non-significant results was the group that underwent pelvic floor muscle training alone.

Table 3. Comparison of overactive bladder score (OABv8) in three groups.

Groups	Moments		ANOVA		
	Initial	Final	Moment	Group	Interaction
G1	24.1 (7.4)	13.3 (5.7)	*P* = 0.001	*P* = 0.001	*P* = 0.001
G2	25.4 (8.8)	3.3 (4.1)	η^2p = 0.748	η^2p = 0.393	η^2p = 0.571
G3	26.7 (7.1)	24.0 (7.1)			

Legend: G1: Transcutaneous tibial electrical stimulation associated with pelvic floor muscle training; G2: Intravaginal electrical stimulation associated with pelvic floor muscle training; G3: Pelvic floor muscle training.

DISCUSSION

Urinary dysfunctions are common characteristics in MS and represent a serious problem due to their high prevalence and consequent social impact. It is estimated that 80% to 90% of patients with MS present some type of lower urinary tract symptoms throughout the disease course, being associated with overactive bladder syndrome[16].
In this scenario, treatments aimed at promoting control of detrusor overactivity and consequently symptoms such as urinary urgency, polyuria, nocturia, and urinary incontinence are noteworthy. Additionally, these treatments aim to enhance bladder storage and emptying efficiency, preserve upper urinary tract function, and reduce complications arising from urinary dysfunction[17].

The aim of this study was to compare different protocols of pelvic floor muscle training on urinary symptoms in women with MS.

In the initial physical assessment of the participants, the groups showed homogeneity regarding urogenital function (perineal sensitivity, anocutaneous reflex, genital dystopia, voluntary contraction, stress test, and Achilles reflex). It is important to note that the integrity of urogenital functions in both groups demonstrates motor and sensory characteristics without alterations; the dermatomes showed unblocked pathways to receive stimuli from the treatment protocol[18].

Regarding the EDSS results of the volunteers, it is important to highlight the initial similarity of neurological functions (EDSS), which allows for a clearer analysis of the benefits generated by the interaction between "group" and "moment." The results showed that the EDSS scores remained unchanged during the treatment, indicating maintenance of the neurological status over the 6-month intervention period. This fact is interesting and provides support for ensuring that the results obtained were due to the treatments performed and not solely to the remissive characteristic of MS.

Initially, we administered the OAB-V8 questionnaire, which revealed that the groups had a moderate initial impairment regarding lower urinary tract symptoms (LUTS), consistent with findings reported in the literature[19]. The most frequent symptoms reported were urinary urgency, urge incontinence, and nocturia.

After 12 weeks of treatment with TMAP, an important finding was observed regarding the assessment using the PERFECT scheme, where Group G2 showed a significant improvement in the number of slow repetitions and in the number of fast repetitions compared to the other two groups (G1 and G3).

We believe that the combination of intravaginal electrostimulation with TMAP was the most effective protocol for perineal strength and endurance training, as it directly targets specific muscles, ensuring improvement in both slow-twitch fibers (type I), which are responsible for maintaining constant tone and continence at rest, as well as fast-twitch fibers (type II), responsible for vigorous and reflex contractions in response to sudden increases in intra-abdominal pressure[20,21].

Although previous studies have demonstrated the effectiveness of TMAP in a home setting[22], in the present study, the expected benefits were not achieved. This may be related to the lack of supervision by a qualified professional, and we attribute these results to the inefficiency of performing the exercises to promote muscle strength and endurance due to the absence of direct supervision by the physiotherapist, which exposes the patient to the risk of performing perineal contractions incorrectly.

A recent systematic review analyzed 7 studies involving 312 women and the effects of supervised and unsupervised PFM training programs on female urinary incontinence. This study demonstrates that both supervised and unsupervised PFM training, when conducted with comprehensive education and regular reassessment, yield better results than unsupervised PFM training without educating patients on correct PFM contractions. Consequently, the study concludes that supervised and unsupervised PFM training programs can be effective in treating UI in women if provided with training sessions and regular reassessments[23].

Overactive bladder represents another common problem in women with MS. Analysis of the OAB-V8 questionnaire demonstrated that all groups had initial impairment, and groups G1 and G2 showed improvement with the therapeutic protocols. Although more significant results were found in patients who underwent intravaginal electrostimulation associated with TMAP, the findings confirm the need for combining electrotherapy with kinesiotherapy in a laboratory setting to maximize results.

In the experimental groups (G1 and G2), the use of perineal electrostimulation was based on the need to inhibit involuntary contraction of the detrusor muscle. We used low-frequency stimulation as a premise to promote central inhibition of parasympathetic motor neurons, which resulted in significant outcomes when combined with conventional kinesiotherapy[17].

In the literature, we can find some studies similar to the present work. One study, compared pelvic floor training with three different protocols for LUTS in women with MS[24]. All groups showed reductions in pad weight, frequency of urgency episodes, and urgency urinary incontinence, improvement in all domains of pelvic floor muscle assessment, and lower scores on OAB-V8 and ICIQ-SF questionnaires after treatment. Individuals in the group that combined TMAP with intravaginal electrostimulation (IEES) experienced significantly greater improvement in pelvic floor muscle tone, flexibility, ability to relax the pelvic floor muscles, and OAB-V8 scores when compared to individuals in the groups with TMAP and Tibial Electrostimulation and Placebo Electrostimulation. The authors concluded that the combination of TMAP and electrostimulation (IEES) offers some advantage in reducing pelvic floor muscle tone and overactive bladder symptoms[24].

Another similar study[17] compared isolated TMAP versus TMAP associated with IEES and demonstrated that the most effective protocol was TMAP associated with IEES on urinary symptoms (p = 0.001) compared to the group that performed TMAP at home without supervision[17].

On the other hand, a study conducted with women with idiopathic overactive bladder without neurological alterations, found a significant reduction in the number of daily voids, episodes of nocturia, and urgency incontinence in both pelvic floor training groups, but the difference was more substantial in women treated with Percutaneous Tibial Nerve Stimulation (PTNS), which is a minimally invasive technique used in patients unresponsive to other therapies. Urinary volume increased in both groups, quality of life improved in both groups, while patients' urgency perception improved only in women treated with PTNS. The overall impression of improvement revealed greater satisfaction in patients treated with PTNS. The study reinforces the efficacy of PTNS and EEIV with TMAP in women with OAB, but greater improvements were found with PTNS[25].

In another study, a comparison of protocols of transcutaneous tibial nerve stimulation for idiopathic overactive bladder was conducted with different protocols: unilateral TTES, bilateral TTES, and placebo. This study found that unilateral TTES twice a week was superior to the once-a-week protocol and placebo in terms of urinary incontinence frequency. Nocturia improved with the bipodal protocol twice a week. Therefore, this study concluded that unilateral stimulation improves daily urinary frequency, urgency, and incontinence, and bipodal stimulation improves nocturia[26].

A study assessed the acute effect of TTES on 44 patients with detrusor overactivity during urodynamic studies. Among them, 37 had bladder overactivity due to multiple sclerosis. Posterior tibial nerve stimulation was associated with a significant improvement in the volume of the first involuntary detrusor contraction ($p<0.0001$) and a significant improvement in maximum cystometric capacity ($p<0.0001$). The test was considered positive in 22 of the 44 patients. The authors conclude that the improvement in bladder overactivity is an encouraging argument for proposing posterior tibial nerve stimulation as a non-invasive treatment modality in clinical practice[18].

It's also important to note that the proposed protocols were well accepted by patients with MS, as evidenced by the absent of sample loss on groups. Although it became difficult to control the frequency of exercises in the control group (as their activities were conducted at home), it's worth mentioning that researchers maintained constant contact via phone.

Finally, it's worth emphasizing that by applying two protocols for strengthening the pelvic floor muscles associated with electrostimulation in patients who were not using medication, it was never our intention to propose the replacement of one therapy with another. Our intention with this methodological design was to emphasize the effect of the proposed therapies, isolating the effect of medication. We believe that our results align with those outlined by the guidelines of the American College of Physicians and such therapies can be applied concurrently with medication treatment[27].

LIMITATIONS

While we recognize the strengths of the study, its limitations should not be overlooked. First, only participants with moderate MS impairment (EDSS 3.0–6.5) were included, as mild-stage patients rarely exhibit six months of urinary dysfunction, and severe cases were excluded due to physical limitations that could bias results.

Secondly, we must emphasize that the neurological impairment caused by MS is not always uniform among all patients – due to the demyelination processes occurring in the Central Nervous System. In this case, conducting a comprehensive neurological and urodynamic assessment, highlighting the dysfunctions present in each case, becomes essential.

Third, the small sample size reflects the challenges of recruiting patients with specific lower urinary tract symptoms of within the established degree of neurological impairment (EDSS), as well as the complexity of diagnosing MS, which requires integrating clinical evaluation with laboratory tests, not always available[2].

Lastly, the absence of a control group without physiotherapeutic treatment limits comparisons, though ethical considerations justified providing treatment to all participants. A double-blind design was unfeasible given the nature of the training protocols.

CONCLUSION

The results of this study reinforce that Pelvic Floor Muscle Training associated with intravaginal neuromuscular stimulation potentiates the reduction of lower urinary tract symptoms and increases the contractility of pelvic floor muscles (both fast and slow fibers). It was also observed that TMAP associated with tibial nerve electrostimulation also has some relevance, as an alternative option or in cases where vaginal access is not possible. Regarding unsupervised TMAP, the results were unsatisfactory in this study. Further research is still necessary to investigate the long-term effects of these treatments.

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