EVALUATING THE EFFECTS OF TRANSCUTANEOUS TIBIAL NERVE STIMULATION AND PELVIC FLOOR MUSCLE TRAINING ON SEXUAL DYSFUNCTION IN FEMALE MULTIPLE SCLEROSIS PATIENTS REPORTING OVERACTIVE BLADDER

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Abstract

Introduction: Sexual dysfunction (SD) is common in female patients with multiple sclerosis (MS) reporting overactive bladder (OAB) symptoms. The aim of the study was evaluate the effects of transcutaneous tibial nerve stimulation (TTNS) and pelvic floor muscle training (PFMT) with biofeedback on SD in female patients with MS reporting OAB symptoms. Methods: Patients with overactive bladder and SD were allocated to receive TTNS or PFMT daily. Overactive bladder symptoms, sexual functions, and sexual quality of life were assessed at baseline and six weeks. Female Sexual Function Index (FSFI), Overactive Bladder Questionnaire (OABv-8), and Sexual Quality of Life-F (SQoL-F) questionnaires were used.

Results: Thirty patients (TTNS=10, PFMT=20) were included in the study. Compared to baseline, total FSFI (p=0.005, p=0.002), OABv-8 (p=0.011, p=0.001), and SQoL-F (p=0.444, p=0.001) scores improved in both TTNS and PFMT groups. Between-group comparisons did not show any significant differences.

Conclusion: This study demonstrates the efficacy of both TTNS and PFMT for improving sexual function in female MS patients with OAB symptoms, but did not show superiority of any particular method. Further studies are required to investigate the differences between these two non-invasive methods.

Keywords: Transcutaneous tibial nerve stimulation, pelvic floor muscle training, sexual dysfunction female, overactive bladder, multiple sclerosis

Introduction

Multiple sclerosis (MS) is frequently associated with sexual dysfunction (SD), which deteriorates the life quality of female patients [1]. Women variably report SD, ranging between 17% and 85% of female patients and dysfunctions are reported in sexual interest, arousal, vaginal lubrication, sensation, orgasm, and satisfaction [2]. Because of social barriers to seek medical treatment for the symptoms, SD often remains underrecognized [3].

Bladder dysfunction results in impaired sexuality and is present in up to 80% of patients with MS. It is reported that urinary symptoms in female MS patients are associated with reduced lubrication, impaired genital sensation leading to anorgasmia. Although the specific mechanism underlying the association between the overactive bladder (OAB) and SD is not fully understood, the treatment of OAB is known to improve patients' sexual life [4].

The effectiveness of pharmacological methods in the treatment of SD in female MS patients has not been fully elucidated. Studies on nonpharmacological methods (pelvic floor muscle exercise and tibial nerve stimulation) for SD are limited [5,6]. Pelvic floor muscles (PFMs) are known to have an essential role in normal sexual function as they are responsible for the involuntary rhythmic contractions during orgasm and vaginal sensation during intercourse. Pelvic floor muscle exercises are useful not only in improving urinary but also in sexual dysfunction (arousal, lubrication, satisfaction) by strengthening the PFMs in female patients with MS [5,7].

Another option, transcutaneous tibial nerve stimulation (TTNS) is a non-invasive, easy to use method compared to other nerve stimulation techniques and can be self-administered at home after instruction by a nurse [8,9]. TTNS is used to treat pelvic floor dysfunction via stimulation of the sacral plexus at S2-4. Although recent studies have shown that TTNS is useful in the treatment of OAB symptoms, there is a limited number of studies examining its effect on SD [10]. There is only a single study reporting that the combination of TTNS and PFMT is effective in improving SD [5]. Clinical studies on SD are needed. The aim of this study was to evaluate the impact of TTNS and PFMT with biofeedback in the treatment of SD in female patients with MS reporting OAB symptoms.

1. Materials and Methods

This study was a part of a larger project evaluating the effectiveness of two methods, TTNS and PFMT, on symptoms of OAB [11]. This pretest-posttest study was carried out at the outpatient MS clinic of the Istanbul University Hospital between September 2017 and December 2018. The research was conducted according to the Declaration of Helsinki, the Turkish Guidelines on Good Clinical Practice, and relevant national authority requirements and ethics committees (2016/1065). Written informed consent was obtained from patients before enrollment. The sample of the main study

consisted of patients who attended MS clinic and met inclusion criteria, and among them, 30 sexually active patients (TTNS: 10, PFMT: 20) were included in this study.

The study included female MS patients with overactive bladder (OAB score ≥8) (see below), older than 18 years, relapse-free for at least one month, have a stable relationship for at least three months, and sexually active during the month before enrollment and during the study. Patients with anatomical anomalies that could affect pelvic floor muscle contraction or who experienced any difficulties using the devices were not included into the study. A detailed description of inclusion and exclusion criteria have been reported in our earlier study [11]. A subsample of the patients who had sexual dysfunction (Female Sexual Function Index score <26.55) (see below) were analyzed for this study. Patients were allocated into either TTNS or PFMT arm based on the availability of the devices and then they were evaluated. The first author (CPD) gave instructions to patients about self-application at home. The first assessment was carried out after one week in the clinic. Subsequently, the researchers called the patients weekly to evaluate treatment compliance and questioned about the side effects (pain, cramps, vaginal discomfort, etc.). Patients were excluded from the study if they were not compliant.

2.1. TTNS*:* Patients were treated with 30-minute daily TTNS sessions for six weeks. Two electrodes were attached to the patient`s leg, below the left medial malleolus and 5 cm proximal to the distal electrode. Patients underwent electrical stimulation with an adjustable-amplitude fixed pulse width of 200 milliseconds and a frequency of 10 Hz. During the stimulation, the great toe plantar-flexion was observed to confirm the proper placement of electrode site. After confirmation, amplitude of the stimulation was reduced to a level just below the somatic sensory threshold. A Biolito (MTR+ Vertriebs GmbH, Berlin) stimulator was used.

2.2. PFMT*:* 10-minute PFMT sessions were applied to the patients twice a day for six weeks. A biofeedback device (SineBravo) with a vaginal probe was used for pelvic floor muscle training. The patient was instructed how to insert the probe into vagina. The device provided feedback on muscle contraction.

2.3. Outcome Measures

A patient information form, Expanded Disability Status Scale (EDSS), Female Sexual Function Index (FSFI), and Sexual Quality of Life-Female (SQOL-F) questionnaire before and after the treatment were employed in the study. Overactive Bladder Questionnaire (OAB-v8) was used to assess the impact of urinary symptoms.

The sexual function of the patients was evaluated by the FSFI questionnaire, which consists of 19 self-report questions and categorizes SD in terms of six domains: desire, arousal, lubrication, orgasm, satisfaction, and pain. Domain score ranges from 0 to 6.0 and the total score is obtained by

summing domains' scores, ranging between 2.0 to 36.0; a lower score indicated a worse dysfunction. Patients with an FSFI total score lower than 26.55 were considered as having SD [12]. The questionnaire used in this study was validated for the Turkish language and was filled out by the patients during the assessment visits [13].

The SQOL-F questionnaire is a specific, self-report instrument that focuses on sexual self-esteem, emotional, and relationship issues. SQOL-F was validated in Turkish [14]. It consists of 18 items, and each item is rated on a six-point response (from completely agree to completely disagree). The total score ranges between 18-108. A higher score indicates a better female sexual quality of life [15].

OAB-v8 is a screening test that rates how bothered patients are by four overactive bladder symptoms: voiding frequency, urgency, nocturia, and urge incontinence. OAB-v8 was validated in Turkish [16]. Each item is scored on a 6-point Likert scale, where 0 indicates they are not at all bothered, and five indicates they are bothered a very great deal. The score can be obtained from the scale varies between 0 and 40, higher scores indicating burden and severity of the symptoms [17].

EDSS is used for evaluating disability. The EDSS score is assessed during physical examination by evaluating functional systems. Higher scores refer to higher disability level [18].

In this non-randomized study, the primary endpoint was the FSFI score, while the secondary endpoint was the OAB score. Patients with a baseline FSFI total score no higher than 26.55 who had a 6^{th}-week FSFI score higher than 26.55 after the interventions (if the increase in FSFI was >20%) were considered SD objective responders [19]. Patients showing a decrease of at least 10 points of the OAB-v8 scores were considered OAB objective responders [20].

1.4. Statistical Analysis

Data analysis was performed using the SPSS Program (v.21.0, IBM). The demographic and outcome variables were presented as percentages when the variables were categorical, as mean, median, and standard deviation when the variables were continuous. Wilcoxon test was used to compare study outcomes before and after the intervention and Mann Whitney U test was used to compare means. Correlations between differences in FSFI score and OAB-v8 scores were evaluated by Spearman analysis. For significance p value was set as ≤ 0.05.

2. Results

Thirty-six female MS patients were included in this study. Six non-compliant patients (two from TTNS and four from the PFMT group) were excluded from the study. None of the patients experienced any significant adverse effect. The mean age of the participants was 42.80±7.74 years. All patients were married. Sociodemographic characteristics of the patients were similar in both study arms ($p>0.05$) (Table 1).

Table 1. Sociodemographic characteristics of the patients

The duration of MS was higher than seven years, and the majority of patients had relapsing-remitting MS. Bladder symptoms have been present for about seven years. In terms of clinical characteristics, the patients in both study arms were similar ($p > 0.05$) (Table 2).

Table 2. Clinical characteristics of the patients

3.1. The Effectiveness of TTNS and PFMT on FSFI scores

In our study, the lowest scores were obtained from desire, arousal, and orgasm domains. The highest scores were in the pain domain in both groups before and after the interventions. Compared to baseline, in the TTNS group, all FSFI scores improved after the intervention ($p<0.005$, except for pain), while only desire ($p=0.050$), orgasm ($p<0.001$) and satisfaction ($p=0.016$) improved in the PFMT group. Although there were no statistically significant differences, at baseline TTNS group was worse in most parameters. When TTNS and PFMT groups were compared after treatment, the only difference was found in the orgasm domain (3.60 vs. 4.60, $p=0.007$). But this domain was already worse at baseline in the TTNS group ($p=0.053$). When we compared the two groups for superiority (shown by comparison of two groups in terms of difference from baseline to 6th week), there was no difference between TTNS and PFMT groups (Table 3).

Patients were categorized as being clinically responder based on a >20% increase in FSFI; a previously reported minimal clinically significant improvement value [19]. The percentage of SD objective responders was 70% (7 of 10 patients) in TTNS and 40% (8 of 20) in the PFMT group (Not shown in table).

Table 3. The effect of TTNS and PFMT interventions on sexual functions

3.2. The Effectiveness of TTNS and PFMT Interventions on Scores of OAB-v8 and SFQoL-F

At baseline, the SFQoL-F scores were comparable between the two groups. The SFQoL-F score improved at the end of the intervention, however it was statistically significant in the PFMT group (Table 4). In the PFMT group, there was a significant improvement in the SFQoL-F score at the end of the treatment ($p=0.037$). No differences in benefit were observed between the TTNS and PFMT groups (as demonstared by the comparison of two groups for difference from baseline to 6th week) (Table 4).

Among SD clinically responders, SFQoL-F scores improved from 48.00 (IQR: 38.00-64.00) at baseline to 58.00 (IQR:46.00-66.00) at the end of the treatment in the TTNS group. These scores improved from 52.50 (IQR: 48.00-68.50) to 78.00 (IQR:68.25-97.25) in the PFMT group (Not shown in table).

Table 4. The effect of TTNS and PFMT interventions on score of SFQoL-F

In both groups, compared to baseline, the OAB-v8 score improved at the end of the intervention (p=0.011 for TTNS, p=0.001 for PFMT). When the two methods were compared, the OAB-v8 score was similar at baseline and also after the intervention. When we compared the two groups in terms of benefit from intervention, there was no difference between groups (Table 5).

Table 5. The effect of TTNS and PFMT interventions on score of OAB-v8

To explore a relationship between sexual and urinary dysfunction, we performed a correlation analysis between the improvement obtained in FSFI and OAB scores. Changes in orgasm domain in the TTNS group (r=0.719, p=0.893) and satisfaction domain in the PFMT group (r=0.466, p=0.039) showed significant correlations with change in OAB scores (Table 6).

Table 6. Correlations of improvement in FSFI scores with OABv-8

3. Discussion

SD is common in female patients with MS, along with urinary symptoms. SD negatively affects patients' quality of life [21,22]. However, little is known about treatment options since studies evaluating practical strategies and pharmacological interventions are sparse. Additionally, there is also a limited number of interventional studies.

Recent reports show that minimally invasive/non-invasive treatments (TTNS, PTNS, PFMT with biofeedback) are useful in the treatment of OAB symptoms in female MS patients [5,23]. Although these methods used in the treatment of OAB are suggested to be effective in the treatment of SD as well as urinary problems, there is a limited number of studies examining their effectiveness in women with MS [5,6]. As far as we know, there is only one study in the literature comparing the efficacy of electrical tibial stimulation and PFMT [5]. Therefore, this study was conducted to evaluate the efficacy of TTNS and PFMT on sexual function in female MS patients reporting OAB.

In our study, compared to the baseline, patients in both TTNS and PFMT groups showed improvements in most domains of sexual function (FSFI), overactive bladder symptoms (OAB-v8 score), and sexual quality of life (SFQoL-F). Intergroup comparisons (difference from baseline to the end of the intervention) showed that two methods had a similar impact on FSFI, OAB, and SFQoL.

The compliance rate to the therapies was high, as we mentioned in our previous study.[11] We concluded that both methods are safe and feasible.

Female sexuality is complex and rooted in biological, psychosexual, and context-related factors and depends on couple dynamics, family, and sociocultural factors [24]. It is also known that urinary problems may play a role in the development of SD by various mechanisms. Among these mechanisms, psychological factors such as anxiety related to intercourse associated urinary incontinence, feeling dirty, low self-esteem, and anatomical factors may result in dyspareunia may be mentioned [25,26]. It has been reported that females with urinary dysfunction often experience problems with arousal, orgasm, lubrication, pain, and satisfaction from intercourse.

Studies suggest that PTNS, which is effective in the treatment of OAB bladder, may also be an effective treatment method in the management of SD [27]. There are two possible mechanisms of action of PTNS; first, by improving urinary symptoms, and second by neuromodulation of the nervous supply to the vulva, vagina, and surrounding musculature, improving the functions of lubrication and genital sensation [19]. It is reported that PTNS reduces urinary dysfunction and improves desire, orgasm, libido, satisfaction, and pelvic pain in females [27]. In our study, similar to the literature, TTNS improved OAB symptoms and total FSFI and subscale scores (except for pain) in the majority of the patients (70% of patients). Besides, our findings demonstrated a positive correlation between the improvements in anorgasmia and OAB symptoms. Although the PTNS has been reported to be effective on chronic pelvic pain [19,28] our study, despite a high basal pain domain score, did not show any improvement in this domain.

Pelvic floor muscles in women with MS are usually weak. Pelvic floor muscle weakness and urinary dysfunction can cause SD related to various factors (satisfaction and orgasm) [29]. Improving pelvic floor muscle tone and circulation, pelvic floor muscle training (PFMT) contributes via improving the sexual desire, ability to reach orgasm, and awareness of the genital area [30,31]. These findings may probably be explained by the fact that PFMT results in changes in muscle morphology by increasing cross-sectional diameter. PFMT may also affect sexual function by enhancing vascular supply to the genital organ, mainly to the pelvic floor muscles, which is responsible for engorging the clitoris during the arousal phase [32]. It has been reported that, in women with MS, PFMT improves arousal, lubrication, satisfaction, and total FSFI score when applied alone and improves all domains (except for pain) when applied together with TTNS [5]. In concordance with our results, the authors did not find any difference between the two methods. In our study, PFMT group showed improvement in desire, orgasm, satisfaction and total FSFI scores and this improvement was clinically significant in approximately half of the patients (40%). It has also been shown that the improvement in sexual satisfaction is highly correlated with the improvement in OAB symptoms. These findings of our study are thought to be due to the contribution of PFMT in ameliorating urinary problems, as well as

increasing pelvic floor awareness, and pelvic floor muscle tone. Although our results revealed that in most cases, the FSFI scores did not reach values above the cut-off point, in line with the literature [5], improvement obtained by both methods is a promising finding. When the two methods were compared, there was a tendency for improvement in the lubrication domain in the TTNS group (p=0.082).

Sexuality is a complex issue with many psychological and emotional factors affecting overall sexual function and quality of life. SD is reported to reduce the quality of life of women with MS [2]. In our study, the PFMT was found to improve the sexual quality of life of patients with MS. This improvement may have resulted from the impact of PFMT on desire, orgasm, satisfaction, and also urinary dysfunction, as well as relieving patients' distress. Failure to achieve a significant improvement in the quality of life of patients in the TTNS group may have resulted from some clinical features of the patients (worse physical disability, longer duration of disease and bladder problem).

Some limitations of our study should be taken into account, such as not evaluating patients with urodynamic studies, not evaluating pelvic floor muscle strength before and after the PFMT, and a short follow-up period. As the results are based on patient-reported outcomes and female sexuality is a complex multifactorial issue in which psychological factors may play an important role, the impact of a placebo-effect could not be excluded. Since an MS-specific sexuality questionnaire (MSISQ, etc.) was not validated in the Turkish language, a generic scale (FSFI) was used. Although FSFI is a commonly used questionnaire, it may not capture all symptoms specific to this patient group. Neither the researchers nor the subjects were blinded. An important limitation in this study is the lack of a control group. Therefore, a double-blind randomized controlled study could be conducted in the future to confirm our results. Not grouping the patients according to their menopausal status was another limitation. Additionally, the omission of psychiatric assessment and the relationships of the patients with their spouses may have influenced both QoL and the sexual functioning of patients.

In conclusion, both TTNS and PFMT are feasible treatment options for the management of SD in female MS patients with OAB. Both methods seem to be effective with significant improvement in sexual desire, orgasm, satisfaction, and bladder dysfunction, as well as improved SQoL (in PFMT group). Further studies are required to understand differences between two methods. Our conclusions apply only to female patients. Therefore, further studies including male patients should be conducted to evaluate the effectiveness of these treatments in male patients.

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Table 1. Sociodemographic characteristics of the patients

Characteristics	**TTNS (n=10)**	**PFMT (n=20)**	**All patients (n=30)**	**Z**	**p**
	$\bar{X}$±SD /M (IQR)	**$\bar{X}$±SD /M (IQR)**	**$\bar{X}$±SD /M (IQR)**		
Age	44.20±9.29 41.00 (38.00-47.75)	42.10±7.00 42.50 (39.00-47.25)	42.80±7.74 42.00 (38.0-45.75)	-0.088	0.930
BMI (kg/m^2)	25.65±4.93 24.34 (22.69-30.68)	26.39±4.45 26.68 (23.93-28.08)	26.14±4.54 26.01 (23.70-28.80)	-0.264	0.792
Number of children	2.38±1.50 2.00 (2.00-2.00)	2.15±0.67 2.00 (2.00-2.00)	2.21±0.96 2.00 (2.00-2.00)	-0.319	0.749
	n (%)	**n (%)**	**n (%)**	**χ^2**	**p**
Education					
<High school	3 (30.0)	12 (60.0)	15 (50.0)	2.400	0.121
≥High school	7 (70.0)	8 (40.0)	15 (50.0)		
Marital status					
Married	10 (100.0)	20 (100.0)	30 (100.0)	-	-
Having a child					
Yes	8 (80.0)	20 (100.0)	28 (93.3)	-	0.103*
No	2 (20.0)	0 (0.0)	2 (6.7)		

BMI: Body mass index; M: Median; PFMT: Pelvic floor muscle training; TTNS: Transcutaneous tibial nerve stimulation; IQR: Interquartile range; X±SD: Mean±standard deviation; Z: Mann Whitney U test; χ2: Chi-square test; *: Fisher test

Table 2. Clinical characteristics of the patients

Characteristics	**TTNS (n=10)**	**PFMT (n=20)**	**All patients (n=30)**	**Z**	**p**
	$\bar{X}$±SD /M (IQR)	**$\bar{X}$±SD /M (IQR)**	**$\bar{X}$±SD /M (IQR)**		
Time since diagnosis (y)	17.60±11.14 14.00 (10.00-26.25)	11.75±8.00 10.00 (7.00-16.00)	13.70±9.40 10.00 (7.00-18.50)	-1.768	0.077
EDSS	3.85±1.61 3.25 (2.37-5.62)	3.18±1.46 3.00 (2.00-3.88)	3.40±1.52 3.00 (2.00-4.62)	-0.976	0.329
Duration of bladder symptoms (y)	8.20±7.09 5.50 (2.75-11.50)	7.03±5.78 6.50 (2.00-10.00)	7.42±6.15 6.00 (2.00-10.00)	-0.510	0.610
	n (%)	**n (%)**	**n (%)**	**χ^2**	**p**
Type of MS					
Relapsing-remitting	8 (80.0)	19 (95.0)	27 (90.0)	-	0.251*
Progressive	2 (20.0)	1 (5.0)	3 (10.0)		
EDSS					
<3.5	5 (50.0)	12 (60.0)	17 (56.7)	0.271	0.602
≥3.5	5 (50.0)	8 (40.0)	13 (43.3)		

EDSS: Expanded disability status scale; PFMT: Pelvic floor muscle training; TTNS: Transcutaneous tibial nerve stimulation; IQR: Interquartile range; Z: Mann Whitney U test; χ2: Chi-square test; *: Fisher test.

Table 3. The effect of TTNS and PFMT interventions on sexual functions

FSFI Domains		TTNS (n=10)		PFMT (n=20)		Z*	p
		X±SD	M (IQR)	X±SD	M (IQR)		
Desire	Baseline	2.40±0.94	2.40 (1.65-3.0)	2.91±1.07	3.0 (1.95-3.45)	-1.315	0.188
	6th week	3.42±0.90	3.60 (3.45-3.60)	3.45±1.35	3.60 (2.55-4.65)	-0.069	0.945
	Δ	1.02±0.90	1.20 (0.45-1.80)	0.54±1.11	0.60 (-0.45-1.65)	-1.093	0.274
	Z**/p		2.448/ 0.014		1.963/0.050		
Arousal	Baseline	2.52±1.02	2.25 (1.72-3.38)	3.07±0.93	3.15 (2.70-3.82)	-1.505	0.132
	6th week	3.48±1.09	3.60 (2.92-4.35)	3.48±1.38	3.60 (2.18-4.25)	-0.177	0.860
	Δ	0.96±0.68	0.90 (0.52-1.28)	0.40±1.20	0.45 (-0.22-1.20)	-1.129	0.259
	Z**/p		2.673/0.008		1.555/0.12		
Lubrication	Baseline	3.24±0.91	3.45 (2.70-3.90)	3.85±0.83	3.90 (3.37-4.20)	-1.621	0.105
	6th week	4.11±0.51	4.05 (3.82-4.20)	4.14±0.68	4.05 (3.90-4.72)	-0.248	0.804
	Δ	0.87±0.91	1.05 (0.15-1.35)	0.28±0.83	0.60 (-0.52-0.90)	**-1.734**	**0.083**
	Z**/p		2.302/0.021		1.363/0.173		
Orgasm	Baseline	2.52±1.02	2.25 (1.72-3.38)	3.52±1.24	3.60 (3.20-4.20)	-1.934	0.053
	6th week	3.76±0.43	3.60 (3.50-4.10)	4.54±0.81	4.60 (4.10-5.10)	-2.721	**0.007**
	Δ	0.96±0.83	0.80 (0.30-2.0)	1.02±0.86	1.20 (0.80-1.60)	-0.356	0.722
	Z**/p		2.549/0.011		3.548/<0.001		
Satisfaction	Baseline	3.24±1.02	3.60 (2.60-3.70)	3.64±1.13	3.60 (2.80-4.80)	-0.560	0.576
	6th week	4.08±0.49	4.0 (3.60-4.50)	4.34±1.28	4.80 (3.60-5.20)	-1.073	0.283
	Δ	0.84±1.05	0.40 (0.0-1.50)	0.70±1.13	0.60 (0.0-1.50)	-0.178	0.859
	Z**/p		2.200/0.028		2.402/0.016		
Pain	Baseline	4.68±1.76	5.80 (3.20-6.0)	3.90±1.72	3.60 (2.40-6.0)	-0.958	0.338
	6th week	5.0±1.41	6.0 (3.50-6.0)	4.26±1.40	4.40 (3.30-5.80)	-1.402	0.161
	Δ	0.32±0.90	0.0 (0.0 -0.70)	0.36±1.32	0.0 (-0.40-1.50)	-0.181	0.857
	Z**/p		1.219/0.223		1.290/0.197		
Total	Baseline	18.80±4.43	18.95 (13.95-23.25)	20.90±3.82	21.40 (18.28-24.05)	-1.078	0.281
	6th week	23.85±3.12	23.70 (22.42-26.12)	24.21±4.04	24.85 (22.0-26.90)	-0.638	0.523
	Δ	4.97±3.08	4.0 (2.32-8.12)	3.31±3.44	3.40 (1.92-5.38)	-0.902	0.367

	Z**/p		2.805/0.005		3.080/0.002		

TTNS: Transcutaneous tibial nerve stimulation; PFMT: Pelvic floor muscle training; IQR: Interquartile range; Z*: Mann Whitney U test; Z**: Wilcoxon test; Δ: Difference

Table 4. The effect of TTNS and PFMT interventions on score of SFQoL-F

SFQL-F	**TTNS (n=10)**		**PFMT (n=20)**		**Z***	**p**
	X±SD	**M (IQR)**	**X±SD**	**M (IQR)**		
Baseline	60.30±20.36	59.50 (40.25-77.0)	66.50±21.71	64.50 (48.0-85.25)	-0.705	0.481
6th week	65.90±19.72	65.0 (46.0-87.0)	80.20±16.14	76.00 (69.0-97.25)	**-2.091**	**0.037**
Δ	5.60±13.30	4.0 (-6.0-12.75)	13.70±16.89	10.50 (1.50-22.50)	-1.454	0.146
Z**/p		0.765 / 0.444		3.194 / **0.001**		

TTNS: Transcutaneous tibial nerve stimulation; PFMT: Pelvic floor muscle training; IQR: Interquartile range; Z*: Mann Whitney U test; Z**: Wilcoxon test; Δ: Difference

Table 5. The effect of TTNS and PFMT interventions on score of OAB-v8

OAB	**TTNS (n=10)**		**PFMT (n=20)**		**Z***	**p**
	Mean±SD	**Median (IQR)**	**Mean±SD**	**Median (IQR)**		
Baseline	29.30±4.16	28.50 (26.50-32.25)	26.55±7.69	28.00 (21.25-32.50)	-0.771	0.440
6th week	17.90±9.19	19.0 (9.25-25.50)	16.40±10.23	13.00 (8.50-22.75)	-0.419	0.676
Δ	-11.40±9.69	-11.0 (-19.0-(-1.50))	-10.15±10.51	-10.50 (-10.50-(-0.50))	-0.374	0.708
Z**/p		**-2.549 / 0.011**		-3.262 / **0.001**		

TTNS: Transcutaneous tibial nerve stimulation; PFMT: Pelvic floor muscle training; IQR: Interquartile range; Z*: Mann Whitney U test; Z**: Wilcoxon test; Δ: Difference

Table 6. Correlations of improvement in FSFI scores with OABv-8

OABv-8 / FSFI	TTNS (n=10)		PFMT (n=20)		Total (n=30)	
	r	**p**	**r**	**p**	**r**	**p**
Desire	-0.110	0.761	0.064	0.788	0.033	0.861
Arousal	-0.037	0.920	0.358	0.121	0.237	0.207
Lubrication	0.375	0.285	-0.060	0.802	0.065	0.734
Orgasm	0.719	0.019	-0.098	0.680	0.170	0.370
Satisfaction	0.235	0.513	0.466	0.039	0.398	0.030
Pain	0.512	0.130	-0.155	0.513	-0.007	0.970
Total	0.383	0.275	0.218	0.355	0.246	0.190

TTNS: Transcutaneous tibial nerve stimulation; PFMT: Pelvic floor muscle training