ORIGINAL RESEARCH

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Comparison of the Effectiveness of Pelvic Floor Muscle Training, Biofeedback, and Tibial Nerve Stimulation in Overactive Bladder Syndrome: A Prospective Randomized Controlled Study

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ABSTRACT Objective: It was aimed to comparatively assess the effectiveness of pelvic floor muscle training (PFMT), biofeedback (BF), and transcutaneous tibial nerve stimulation (TTNS) treatments in overactive bladder (OAB) patients. **Material and Methods:** The patients presented to the urogynecology outpatient clinic between June 2017 and March 2018. They were randomly divided into Group 1: PFMT (n=31), Group 2: PFMT and BF (n=32), and Group 3: PFMT and TTNS (n=33). Patients who received anticholinergic therapy, those who had a previous incontinence surgery or had neurological diseases, those who were pregnant, those who were breastfeeding, those with abnormal liver-kidney functions, persistent urinary infection, or atrophic vaginitis, and those who did not agree to take part in the study were excluded. The OAB Questionnaire (OAB-V8), the International Consultation on Incontinence Questionnaire-Short Form (ICIQ-SF), and the Female Sexual Function Index forms were filled out before and after the 12-week treatment. **Results:** Daytime and nighttime urinary frequency, total urinary incontinence, and pad test values were lower after the treatment compared to before in all three groups ($p<0.001$). A statistically significant decline was seen in post-treatment ICIQSF and OAB-V8 scores compared to pre treatment scores in all three groups ($p<0.01$). The decrease in daytime urinary frequency was seen to be statistically significant in Group 2, and the values in this group were lower compared to those in Groups 1 and 3 (p: 0.045, p: 0.014, respectively). **Conclusion:** The overall effectiveness of the conservative treatments was determined to be similar. In the selection process, conservative treatment methods should be personalized.

Keywords: Behavioral therapy for urinary incontinence; pelvic floor rehabilitation; urogynecology

Overactive bladder (OAB) syndrome is a complex of symptoms that causes a decline in quality of life by affecting social functions such as the performance of daily activities, work, travel, physical exercise, sleep, and sexual functioning, and it is not a disease.[1] The International Continence Society (ICS) identifies OAB as a syndrome that can be encountered with signs including an increased frequency of daytime urination and urge, as well as nocturia.[2] The prevalence of OAB without incontinence in women was reported as 7.6%, while the prevalence of OAB with incontinence was 9.3%.[3]

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OAB is a treatable disorder. The ICS recommends conservative treatment as the first approach to OAB symptoms, and conservative treatments are considered efficient, well-tolerated, and reliable alternatives for treating OAB. Conservative treatments include behavioral training, fluid restriction, the regulation of the gastrointestinal system, timely voiding, avoiding irritant foods, psychotherapy, biofeedback (BF), pelvic floor muscle training (PFMT), pretibial nerve stimulation, and sacral nerve stimulation.[4]

PFMT aims to establish urethral stability by increasing the durability of the pelvic floor muscles.[5] Tibial nerve stimulation (TNS), a peripheral neuromodulation technique, is a dependable and effective treatment method for fecal incontinence, detrusor instability, and OAB.[6] BF treatment facilitates the proper muscular contraction of the pelvic floor muscles. It is a conservative method that increases urethral closure pressure, enables maximal pelvic floor contraction, and reduces detrusor overactivity.[7] This study aimed to assess and compare the efficiency of three current conservative methods, namely PFMT, BF, and TNS, in patients diagnosed with OAB.

MATERIAL AND METHODS

DESIGN AND POPULATION

All procedures involving human participants were performed according to the ethical standards of the Declaration of Helsinki. Sakarya University Ethics Committee approval was obtained before starting the study (date: June 10, 2021; no: 16214662/050.01.04/65).

Patients aged between 18 and 70 who presented to outpatient clinics between June 2017 and March 2018 and diagnosed with urge urinary incontinence (UUI) with urinary leakage ≥2 g on the "volume pad test" (PT) were included in the study. Chronic degenerative diseases, cases of pelvic organ prolapse greater than Grade II, persistent urinary tract infections, neurological diseases such as multiple sclerosis, spinal lesions, psychiatric diseases, present or past use of tricyclic antidepressants or anticholinergics, previous PFMT, a history of incontinence surgery, being pregnant or planning to become pregnant, breastfeeding, suffering from abnormal liver-kidney functions, atrophic vaginitis, stress, mixed urinary incontinence (UI), and refusing to participate in the study were selected as the exclusion criteria. Patients meeting the inclusion criteria who provided verbal and written informed consent by signing the consent form after being informed were included in the study. All patients were educated to provide them with the knowledge and comprehension of their situation, thus empowering them to play an active role in its management.

All patients were recommended to make lifestyle changes such as losing weight, restricting their fluid intake in the evening, quitting smoking, limiting caffeine consumption, and excluding products considered bladder irritants from their diet.

Using a random number generator, 98 women were randomly divided into three groups as follows: Group 1, PFMT only (n=32); Group 2, PFMT+BF (n=32), and Group 3, PFMT+TNS (n=34) PT was applied to all three groups before and after their treatments (Figure 1).

Group 1: PFMT Group

The PFMT exercises consisted of outpatient sessions and home training twice a week for 12 weeks.

A program consisting of three sets of 10 repetitions per day was given. The treatment protocol was individualized and based on the initial assessment made by PERFECT.[8] The patients were instructed to contract their pelvic floor muscles and hold the contraction for a while. Then, this was followed by rapid contractions, which were calculated in the same way. A set of exercises consisted of 10 repetitions of each move (endurance, rest, rapid contractions). No form of therapy was added to PFMT to treat the symptoms of OAB syndrome. The patients were instructed to follow the same protocol they learned during the sessions on a daily basis, their adherence to home exercises was followed up, and they were asked to keep an exercise diary.

Group 2: PFMT and BF Treatment Group

The aim of this intervention was to increase the strength of the pelvic floor muscles of the patients by contracting the PFM without contracting the abdominal muscle to allow them to identify and selectively

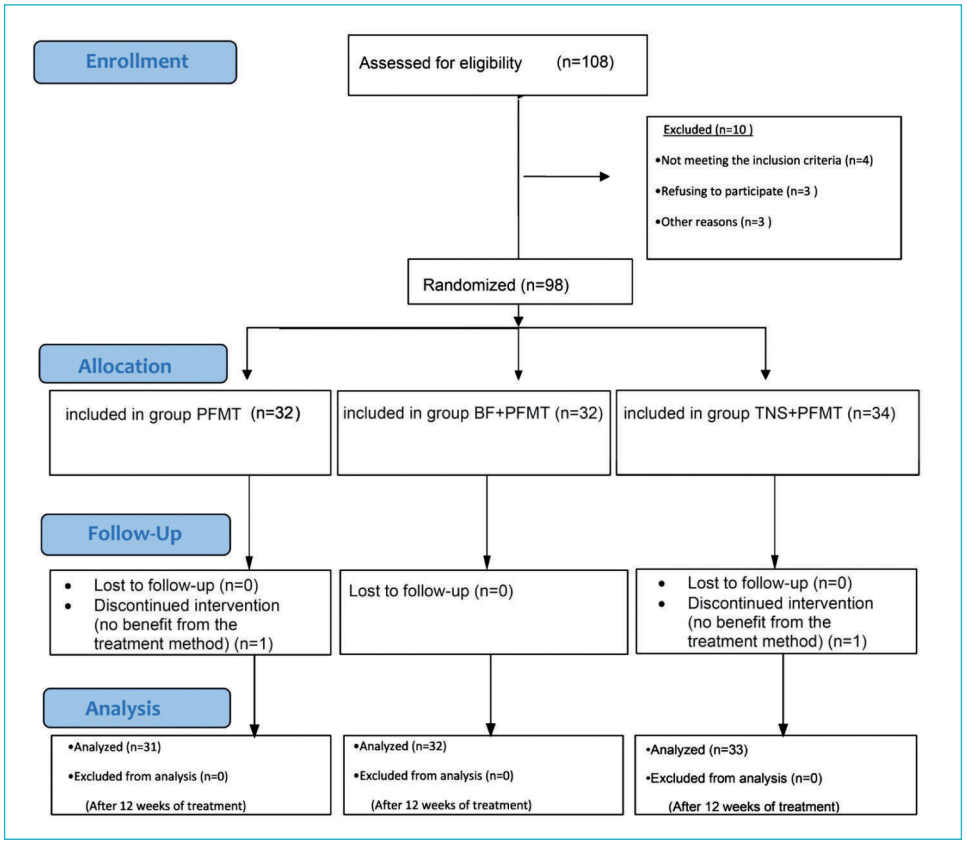

FIGURE 1: CONSORT flow diagram for randomized, controlled trials of the effectiveness conservative methods.
PFMT: Pelvic floor muscle training; BF: Biofeedback; TNS: Tibial nerve stimulation.

use their PFM. BF is a method that enables the contraction and relaxation of the PFM to make these processes comprehensible to the patient on a screen and with sound and allows them to regulate these events themselves.

In this study, BF was applied using the NeuroTrac® MyoPlus 4 Pro (Verity Medical Ltd /United Kingdom) device, suitable for both in-clinic and at-home use. The device has neuromuscular electrical stimulation (ES) programs for incontinence treatment, muscular development, and neuromuscular rehabilitation.

A suitable treatment program (UUI 1) was selected by placing a vaginal probe and an external electrode on the patients. BF treatment was performed on the patients thrice a week for 12 weeks with a 20-minute program in each session. Additionally, the patients were asked to carry out pelvic floor muscle exercises at home.

These techniques are time-consuming, and the success of rehabilitation with BF depends on the motivation and abilities of the patient and the practitioner.

Group 3: PFMT and TNS Group

The patients were referred to a physiotherapist specializing in urogynecology and TNS. Accordingly, external electrodes were used to stimulate the pretibial nerve through the transcutaneous route. The negative electrode was placed at the posterior of the medial malleolus, while the positive electrode was placed 10 cm above the negative electrode. The accuracy of the placement of the electrodes was checked with the rhythmic flexion of the toes via plantar muscle contractions. The stimulation frequency was set to 10 Hz, and the pulse width was set to 200 milliseconds with a neuromuscular ES device.

PFMT was applied to the patients in this group twice a week for 12 weeks with a 20-minute program

in each session in the physiotherapy clinic. Moreover, the patients were asked to carry out PFMT exercises at home.

ASSESSMENT OF URINARY SYMPTOMS

The Overactive Bladder Questionnaire (OAB-V8) allows the patients to rate the severity of their complaints on a scale of "not at all (0), a little bit (1), somewhat (2), quite a bit (3), a great deal (4), and a very great deal (5)". The total score of the questionnaire ranges from 0 and 40. The validity and reliability of the Turkish version of OAB-V8 were tested.[9]

The patients were also instructed to keep a voiding diary for three days. This diary recorded diurnal urinary frequency, urinary leakage, and nocturia in stressful situations, including coughing, sneezing, squatting, laughing, weightlifting, walking, and running.

PFM FUNCTION ASSESSMENT

The Modified Oxford Scale was applied to evaluate the pelvic floor muscle strength of the patients by digital vaginal palpation in the lithotomy position. This scale classifies the strength of the muscles as 0 (no discernible PFM contraction), 1 (a very weak PFM contraction), 2 (a weak PFM contraction), 3 (a moderate PFM contraction), 4 (a good PFM contraction), and 5 (a strong PFM contraction).[8]

ASSESSMENT OF QUALITY OF LIFE AND SEXUAL FUNCTION

The impact of OAB syndrome on quality of life was assessed based on the "International Consultation on Incontinence Questionnaire-Short Form" (ICIQ-SF).[10] The maximum score of 21 is interpreted as the presence of very severe UI, while the minimum score of 0 is interpreted as absolutely no complaints of UI. The patients are asked about their frequency of UI, the approximate amount of leakage, and the overall impact of UI on their life.

The impact of OAB syndrome on sexual function was assessed based on "the Female Sexual Function Index" (FSFI). FSFI is a 19-item self-report questionnaire that applies to all age groups and assesses six domains consisting of sexual desire, arousal, lubrication, satisfaction, orgasm, and pain. The reliability and validity of the Turkish version of FSFI were tested by Aydın et al.[11]

STATISTICAL ANALYSES

"The Number Cruncher Statistical System" 2007 (Kaysville, Utah, USA) program was utilized for the statistical analyses. Descriptive statistics, including mean, standard deviation, median, first quartile, third quartile, frequency, percentage, minimum, and maximum values, were utilized to analyze the data. The normality of the distribution of the quantitative data was tested using the Shapiro-Wilk test and visual methods. The one-way analysis of variance method and Bonferroni-Corrected pairwise comparisons were utilized to compare the quantitative variables that were normally distributed. The Kruskal-Wallis and Dunn-Bonferroni tests were used to compare the quantitative variables that were non-normally distributed among more than two groups. The Wilcoxon signed-rank test was used in the intergroup comparisons of the quantitative variables that were non-normally distributed. The Pearson chi-squared and Fisher-Freeman-Halton exact tests were used to compare the quantitative data. The level of statistical significance was accepted as $p<0.05$.

RESULTS

One hundred eight patients participated in the study. The sample later excluded 12 patients who were not able to continue the study [recurrent urinary infections (n=4), hesitation regarding the treatments (n=3), not benefitting from treatment after four weeks (n=2), and not being able to go on with treatment as a result of social reasons such as distance to the hospital, lack of time, or unsuitable working conditions (n=3)] (Figure 1).

The mean age of the patients was 49.77±9.47, while their mean body mass index was 28.57±4.05 kg/m^2. The results of the comparisons of the demographic characteristics of the patients among the groups are presented in Table 1.

Daytime and nighttime urinary frequency, total UI occasions, and PT values were lower after the treatment compared to before in all three groups ($p<0.001$) (Table 2).

TABLE 1: Comparison of the demographic features by groups.

		Group 1 X̄±SD	Group 2 X̄±SD	Group 3 X̄±SD	p value
Age (years)		47.16±8.96	50.44±9.75	51.58±9.4	[a]0.157
Height (cm)		1.6±0.07	1.62±0.07	1.63±0.08	[a]0.233
Weight (kg)		72.9±10.85	74.31±9.89	76.09±14.02	[a]0.556
BMI (kg/m^2)		28.53±3.32	28.43±4.29	28.74±4.53	[a]0.952
[‡]Gravida		3 (2, 5)	3 (2, 4)	3 (3, 4)	[d]0.565
[‡]Parity		3 (2, 3)	3 (2, 3)	3 (2, 3)	[d]0.737
[‡]Abortus		0 (0, 2)	0 (0, 1)	0 (0, 1)	[d]0.714
[‡]Live		3 (2, 3)	3 (2, 3)	3 (2, 3)	[d]0.635
Maximal baby weight		3643.70±504.95	3694.29±751.34	3501.67±623.74	[a]0.490
[‡]Duration of menopause (years)		0 (0, 6)	2 (0, 10)	3 (0, 8)	[d]0.355
[‡]Duration of symptoms (months)		60 (24, 120)	60 (18, 120)	84 (24, 120)	[d]0.658
Menopausal status	No	17 (54.8)	14 (43.8)	16 (48.5)	[b]0.677
	Yes	14 (45.2)	18 (56.3)	17 (51.5)	
HRT	No	25 (80.6)	27 (84.4)	29 (87.9)	[b]0.691
	Yes	6 (19.4)	5 (15.6)	4 (12.1)	
Occupation	Housewife	28 (90.3)	29 (90.6)	32 (97)	[b]0.553
	Other	3 (9.7)	3 (9.4)	1 (3)	
Smoking	No	18 (58.1)	22 (68.8)	25 (75.8)	[c]0.315
	Yes	13 (41.9)	10 (31.3)	8 (24.2)	
Alcohol use	No	30 (96.8)	30 (93.8)	32 (97)	[b]0.840
	Yes	1 (3.2)	2 (6.3)	1 (3)	
Exercise	No	29 (93.5)	28 (87.5)	33 (100)	[b]0.095
	Yes	2 (6.5)	4 (12.5)	0 (0)	

[a]One-way analysis of variance; [b]Pearson chi-square test; [c]Fisher-Freeman-Halton exact test; [d]Kruskal-Wallis test; [‡]The data were presented as median (first quarter, third quarter); No statistically significant difference was detected between the groups in terms of the duration of symptoms (p>0.05), HRT: Hormone replacement therapy.

It was found that the decrease in daytime urinary frequency values was statistically significant in Group 2. According to the results of the pairwise comparisons, the daytime urinary frequency values of the patients in Group 2 were lower than those in Groups 1 and 3 (p: 0.045, p: 0.014, respectively) (Table 3).

No statistically significant difference was found among the groups in terms of their post-treatment nighttime urinary frequency, total incontinence, or PT values (p>0.05)

The muscle strength values of all groups after the treatment were significantly higher than their values before the treatment (p<0.001). Based on their muscle strength values measured by digital palpation, there was no significant difference among the groups in terms of the change in their values from the pre-treatment to the post-treatment measurements (p>0.05)

The post-treatment ICIQ-SF and OAB-V8 scores of all groups were significantly lower than their pre-treatment scores (p<0.01). On the other hand, no statistically significant change was found in the post-treatment FSFI scores of any group compared to their pre-treatment FSFI scores (p>0.05) (Table 4). There was no statistically significant difference among the groups in terms of the degrees of change in their ICIQ-SF, OAB-V8, and FSFI scores from the pre-treatment to the post-treatment measurements (p>0.05) (Table 4).

DISCUSSION

In this study, three different conservative methods were applied among patients who were randomly divided into groups. As a result, it was determined that in all three groups, post-treatment daytime and nighttime urinary frequency, total incontinence, and PT

TABLE 2: Comparison of pre-treatment and post-treatment patient symptoms by the methods applied.

	Group 1			
	Pre-treatment Median (Q1, Q3)	**Post-treatment Median (Q1, Q3)**	**Change Median (Q1, Q3)**	**p value**
Daytime urinary frequency	10 (8, 13)	6 (5, 7)	-5 (-6, -2)	[e]<0.001**
Nighttime urinary frequency	4 (3, 4)	1 (0, 2)	-2 (-3, 0)	[e]<0.001**
Total incontinence	3 (2, 4)	1 (0, 2)	-2 (-3, -1)	[e]<0.001**
Pad test	22 (10, 45)	5 (0, 12)	-13 (-36, -5)	[e]<0.001**
	Group 2			
	Pre-treatment Median (Q1, Q3)	**Post-treatment Median (Q1, Q3)**	**Change Median (Q1, Q3)**	**p value**
Daytime urinary frequency	11 (8, 11)	5 (4, 6)	-4.5 (-6.5, -3)	[e]<0.001**
Nighttime urinary frequency	3 (2, 5)	1 (0, 2)a	-2 (-3, 0)	[e]<0.001**
Total incontinence	3.5 (1.5, 5)	0 (0, 1)	-2.5 (-4, -1)	[e]<0.001**
Pad test	28.5 (16, 44.5)	0 (0, 9)	-24.5 (-37, -15)	[e]<0.001**
	Group 3			
	Pre-treatment Median (Q1, Q3)	**Post-treatment Median (Q1, Q3)**	**Change Median (Q1, Q3)**	**p value**
Daytime urinary frequency	8 (7, 11)	6 (5, 7)	-3 (-5, -1)	[e]<0.001**
Nighttime urinary frequency	4 (3, 4)	1 (0, 2)	-2 (-4, 0)	[e]<0.001**
Total incontinence	4 (2, 4)	0 (0, 1)	-2 (-4, -1)	[e]<0.001**
Pad test	25 (17, 38)	0 (0, 10)	-19 (-29, -8)	[e]<0.001**

The data were presented as median (first quarter, third quarter); [e]Wilcoxon signed-ranks test; **p<0.01.

TABLE 3: Comparison of the methods applied (between each other) in terms of patient symptoms.

Pre-treatment	**Group 1 Median (Q1, Q3)**	**Group 2 Median (Q1, Q3)**	**Group 3 Median (Q1, Q3)**	**Test value**	**p value**
Daytime urinary frequency	10 (8, 13)	11 (8, 11)	8 (7, 11)	3.112	[d]0.211
Nighttime urinary frequency	4 (3, 4)	3 (2, 5)	4 (3, 4)	0.418	[d]0.812
Urinary incontinence	3 (2, 4)	3.5 (1.5, 5)	4 (2, 4)	0.806	[d]0.668
Pad test	22 (10, 45)	28.5 (16, 44.5)	25 (17, 38)	0.447	[d]0.800
Post-treatment	**Group 1 Median (Q1, Q3)**	**Group 2 Median (Q1, Q3)**	**Group 3 Median (Q1, Q3)**	**Test value**	**p value**
Daytime urinary frequency	6 (5, 7)	5 (4, 6)	6 (5, 7)	9.435	[d]0.009**
Nighttime urinary frequency	1 (0, 2)	1 (0, 2)	1 (0, 2)	0.407	[d]0.816
Urinary incontinence	1 (0, 2)	0 (0, 1)	0 (0, 1)	2.903	[d]0.234
Pad test	5 (0, 12)	0 (0, 9)	0 (0, 10)	2.190	[d]0.335
Change	**Group 1 Median (Q1, Q3)**	**Group 2 Median (Q1, Q3)**	**Group 3 Median (Q1, Q3)**	**Test value**	**p value**
Daytime urinary frequency	-5 (-6, -2)	-4.5 (-6.5, -3)	-3 (-5, -1)	5.760	[d]0.056
Nighttime urinary frequency	-2 (-3, 0)	-2 (-3, 0)	-2 (-4, 0)	0.010	[d]0.995
Urinary incontinence	-2 (-3, -1)	-2.5 (-4, -1)	-2 (-4, -1)	3.879	[d]0.144
Pad test	-13 (-36, -5)	-24.5 (-37, -15)	-19 (-29, -8)	2.883	[d]0.237

The data were presented as median (first quarter, third quarter); [d]Kruskal -Wallis test; **p<0.01.

values were lower compared to pre-treatment values, while the patients also had significantly lower ICIQ-SF and OAB-V8 scores (p<0.001) (Table 2 and Table 4). In the intergroup comparisons of the degrees of decrease in their values, there was a significantly higher degree of decrease in the daytime urinary frequency of the patients in Group 2 (Table 3). On the other hand, there was no significant difference among

TABLE 4: Comparison of the pre-treatment and post-treatment quality of life scales by the methods applied.

		Group 1		
	Pre-treatment Median (Q1, Q3)	**Post-treatment Median (Q1, Q3)**	**Change Median (Q1, Q3)**	**p value**
FSFI	56 (19, 68)	56 (22, 70)	0 (0, 6)	[e]0.089
ICIQ-SF	16 (11, 19)	9 (4, 12)	-6 (-10, -2)	[e]<0.001**
OAB-V8	30 (27, 32)	12 (11, 18)	-15 (-18, -10)	[e]<0.001**
		Group 2		
	Pre-treatment Median (Q1, Q3)	**Post-treatment Median (Q1, Q3)**	**Change Median (Q1, Q3)**	**p value**
FSFI	60.5 (34, 73)	63.5 (17.5, 72.5)	1.5 (-4, 6.5)	[e]0.674
ICIQ-SF	17.5 (12.5, 19)	7 (3.5, 12.5)	-7.5 (-10.5, -4)	[e]<0.001**
OAB-V8	31 (22, 35.5)	14 (7.5, 17.5)	-16 (-22, -7.5)	[e]<0.001**
		Group 3		
	Pre-treatment Median (Q1, Q3)	**Post-treatment Median (Q1, Q3)**	**Change Median (Q1, Q3)**	**p value**
FSFI	42 (2, 56)	42 (2, 64)	0 (0, 7)	[e]0.004**
ICIQ-SF	17 (15, 21)	9 (4, 16)	-6 (-11, -3)	[e]<0.001**
OAB-V8	36 (32, 38)	16 (9, 29)	-18 (-28, -8)	[e]<0.001**

The data were presented as median (first quarter, third quarter); [e]Wilcoxon signed-ranks test; **p<0.01; FSFI: Female Sexual Function Index; ICIQ-SF: International Consultation on Incontinence Questionnaire-Short Form; OAB-V8: Overactive Bladder Questionnaire.

the groups in terms of their scale scores (p>0.05) (Table 4).

In a review study, it was reported that BF therapy was an increasingly popular approach to UI treatment. It was also emphasized that BF was effective in UUI, as determined in this study, and added to PFM exercises.[12]

Different conservative methods were examined in a previous study, including PFMT, PFMT+BF, PFMT+ES, and PFMT+BF+ES. Similar to this study, a significant improvement was seen in all groups in terms of their voiding frequencies, nocturia statuses, and incontinence episodes. However, it was shown that the groups involving ES achieved the most effective combination of quality of life and nocturia, and the BF intervention was more effective alone than the PFMT intervention.[13]

Wang et al. compared the combinations of BF, BF+PFMT, and intravaginal electrode+PFMT for 12 weeks, and the recovery rate was higher in the BF group. This study utilized ES with an intravaginal electrode instead of TNS.[14]

In a different study, one group of patients was instructed to perform exercises with BF, while the other group was instructed to perform exercises without BF. A considerable improvement was seen in the BF group after 12 weeks. A meta-analysis conducted on this subject reported that exercise with BF produced more positive results.[15]

Sung et al. reported that the amount and frequency of UI were significantly lower in the group that underwent BF and functional ES interventions compared to the group that underwent a PFMT intervention.[16]

In another study, BF, ES, and PFMT were compared, and it was seen that the most significant improvement in terms of quality of life scores was observed in the BF group.[17]

In a similar study, BF-assisted behavioral training, behavioral training without BF (verbal feedback based on vaginal palpation), and a self-applied behavioral training protocol with a help booklet were applied. Unlike the results of this study, no difference was found in treatment effectiveness among the three groups based on their incontinence episodes, voiding diaries, patient satisfaction, and quality of life. However, it was seen that the patients in the group where behavioral training was applied without BF had higher levels of satisfaction (p=0.001).[18]

A recent study reported that BF-assisted PFMT effectively treated OAB in women, significantly reduced their symptoms and complaints, and increased their quality of life.[19] In a different study, 60 women with OAB were randomly divided into two groups. PFMT and ES were applied in one group, and percutaneous TNS was applied in the other group. Both groups showed a statistically significant decline in daytime voiding frequency, nocturia episodes, and urge incontinence. However, a further decrease was observed in the group treated with percutaneous TNS. While quality of life outcomes improved in both groups, the frequency only improved in the group treated with percutaneous TNS. As a result, percutaneous TNS was superior to ES.[20] Similarly, in this study, an improvement was determined in all three groups, but it was observed that the treatment with BF was more effective in reducing the frequency of daytime urination.

Strong correlations were reported between OAB and persistent sexual arousal syndrome in studies in the literature.[21] Accordingly, it was revealed that sexual dysfunction improved in patients with OAB after treatment with percutaneous TNS.[22] In this study, as opposed to the case in the relevant literature, no statistically significant difference was seen in FSFI scores after the treatment ($p>0.05$) (Table 4).

It was determined that transcutaneous TNS was superior to PFMT and behavioral training among elderly patients with OAB symptoms in improving voiding diary results after 12 weeks.[23] Additionally, a systematic review involving seven studies reported that percutaneous TNS was effective for treating OAB. However, a larger number of randomized controlled studies was required for conclusive evidence due to the possibility of bias and the small scope of the included studies.[24]

One of the most critical deficits in the literature is that the number of long-term follow-ups regarding conservative treatment protocols is inadequate. A previous study examined the long-term effectiveness and reliability of percutaneous TNS after three years of treatment and follow-up. Most participants who initially responded positively to the 12-week percutaneous TNS treatment recovered from OAB symptoms within three years, with an average of 1 percutaneous TNS treatment per month.[25] This study's lack of post-treatment urodynamic evaluations and long-term follow-up of the patients was a limitation. Additionally, the absence of a group with combined medical treatment, the exclusion of patients with anxiety disorders expected to escalate due to UI, and the fact that the participants were not screened for depression may be listed as other limitations of the study. On the other hand, there is a limited number of studies in the relevant literature comparing these three treatment groups. Therefore, this study is thought to contribute to the literature in this sense.

CONCLUSION

Today, conservative treatment methods are recommended as the first choice in treating OAB because they are economical, non-invasive, easily applicable, and have high patient compliance rates, fewer side effects, and positive outcomes. It has been reported in the literature that conservative treatment methods could be used individually or in the form of combinations. The results of this study revealed that combinations including BF can improve frequent urination and urge symptoms.

As the general effectiveness of the treatments that were applied in this study was similar to each other, a personal approach should be adopted in the treatment selection process by considering the ease of follow-up, applicability, personal characteristics, and educational background of the patient. In selecting treatment combinations, the dominant symptoms and preferences of the patient should also be taken into account.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Merve Keskin Paker;* ***Design:*** *Merve Keskin Paker, Hilal Uslu Yuvacı, Orhan Ünal, Nermin Akdemir;* ***Control/Supervision:*** *Merve Keskin Paker;* ***Data Collection and/or Processing:*** *Merve Keskin Paker, Yavuz Kılıç, Kemal Nas, Mehmet Sühha Bostanvı;* ***Analysis and/or Interpretation:*** *Merve Keskin Paker, Hilal Uslu Yuvacı;* ***Literature Review:*** *Merve Keskin Paker, Hilal Uslu Yuvacı, Arif Serhan Cevrioğlu, Selçuk Özden, Nermin Akdemir;* ***Writing the Article:*** *Merve Keskin Paker, Hilal Uslu Yuvacı;* ***Critical Review:*** *Merve Keskin Paker, Hilal Uslu Yuvacı, Nermin Akdemir, Orhan Ünal;* ***References and Fundings:*** *Merve Keskin Paker;* ***Materials:*** *Merve Keskin Paker.*

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