Original Article

Efficacy of optimized pelvic floor training of YUN combined with pelvic floor magnetic stimulation on female moderate stress urinary incontinence and sexual function: a retrospective cohort study

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Background: Owing to its tediousness and monotony, traditional pelvic floor muscle training (PFMT) is difficult to ensure the correctness of exercise, and it is difficult for patients to adhere to treatment. We designed this study to evaluate and analyze the efficacy of optimized pelvic floor training of YUN combined with pelvic floor magnetic stimulation on female moderate stress urinary incontinence (SUI) and sexual function.

Methods: This is a retrospective cohort study. This study was carried out in 95 female patients with moderate SUI. The inclusion criteria were as follows: premenopausal women aged 25–45; moderate SUI; over 3 months of disease duration; informed consent and cooperation with treatment and follow-up. The participants in group 1 (control group, n=46) were treated with pelvic floor magnetic stimulation, while those in group 2 (trial group, n=49) were treated with pelvic floor magnetic stimulation combined with optimized pelvic floor training of YUN. Evaluations were scheduled before the treatment (0 week), after 6 weeks of treatment (6 weeks), and after 12 weeks of treatment (12 weeks). And compare the differences between the two groups.

Results: There was no significant difference in age, body mass index (BMI), duration of disease, and abdominal leak point pressure (ALPP) between the two groups (P>0.05). The total effective rate of the trial group was higher than that of the control group (89.80%, 44/49 *vs.* 78.26%, 36/46) (P<0.05). The electromyographic values, the International Consultation on Incontinence Questionnaire Short Form (ICI-Q-SF) score, Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire-12 (PISQ-12) score, physiological factors, and emotional factors were all improved significantly in both groups after active treatment, and the improvement of the trial group was more obvious (P<0.05).

Conclusions: Optimized pelvic floor training of YUN combined with pelvic floor magnetic are more effective for the treatment of female moderate SUI and sexual function. It has become a safe, effective, and well tolerated new type of pelvic floor functional reconstruction training method with good patient compliance.

Keywords: Stress urinary incontinence (SUI); sexual function; magnetic stimulation; optimized pelvic floor training of YUN; combined treatment

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Introduction

Stress urinary incontinence (SUI) is a common disease among middle-aged and elderly women. It has been reported that about half of middle-aged and elderly women have different degrees of SUI (1). In the United States, 25–50% of women experience SUI and spend more than $12 billion annually on its treatment (2). Although SUI is not immediately life-threatening, it has a serious impact on patients' quality of life and sex life. Research shows that 19–50% of SUI patients also experience/present with sexual dysfunction, which is a much higher rate than that of women with normal urinary control (3).

Treatment modalities range from surgical management and drug therapy to physical therapy such as lifestyle intervention, pelvic floor muscle training (PFMT), electrical stimulation, biofeedback, and magnetic stimulation. A study has shown that the incidence of adverse events in magnetic stimulation therapy is low, with a high degree of treatment satisfaction, and fewer patients withdraw from the treatment (4). A randomized clinical trial in 2015 showed that the cure rate in moderate cases of SUI using pelvic floor magnetic stimulation therapy was as high as 75% (5). Some studies have shown that pelvic floor magnetic stimulation therapy can not only improve the short- and long-term overall health condition of female SUI patients, but also affect their quality of life from physical, social, and psychological aspects (6,7). The International Urinary Incontinence Consultation (ICI) suggests that research of female SUI should evaluate the effect of treatment on sexual function. A study of magnetic stimulation therapy suggested that with the improvement of urinary incontinence symptoms in female SUI patients, their sexual function also improved from both physiological and psychological aspects (8).

Besides lifestyle improvement, PFMT is the most important non-invasive treatment for SUI. The National Institute for Health and Clinical Excellence (NICE) recommends PFMT as the first-line treatment for SUI patients. The total short-term effective rate of PFMT can reach 50–75% (8). There was a systematic review of records, which demonstrated that most of the studies indicated that PFMT can improve the sexual function of female SUI patients and pelvic organ prolapse patients (9). However, in traditional PFMT it is difficult to ensure the correctness of exercise, owing to its tediousness and monotony, and it is difficult for patients to adhere to treatment. Optimized pelvic floor training of YUN is a method to integrate professional and scientific PFMT into a fashionable dance, and it has become a safe, effective, and well tolerated new type of pelvic floor functional reconstruction training method with notably good patient compliance (10). A study showed that the inefficiency rate of PFMT group after treatment (44.8%) was higher than that of functional magnetic stimulation group (9.4%) and combined treatment group (4.77%) (11). The current authors found themselves questioning whether it could be more effective to improve the symptoms, quality of life, and compliance of patients with moderate SUI by amalgamating optimized pelvic floor training of YUN to magnetic stimulation. No relevant study had previously been conducted to investigate this topic. Our goal was therefore to conduct research to explore the clinical effect of pelvic floor magnetic stimulation combined with optimized pelvic floor training of YUN on moderate SUI in women. We present the following article in accordance with the STROBE reporting checklist (available at https://tau.amegroups.com/article/view/10.21037/tau-22-222/rc).

Methods

Study design

This is a retrospective cohort study. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by ethics board of The Fifth People's Hospital of Shanghai (No. 20180801-1). Informed consent was taken from all the patients. The inclusion criteria were as follows: premenopausal women aged 25–45; moderate SUI; over 3 months of disease duration; informed consent and cooperation with treatment and follow-up. Patients were excluded if the following conditions applied: pregnancy, urinary tract infections, other forms of urinary incontinence, neurological diseases, cardiovascular and cerebrovascular diseases, metal pelvic implants, and cardiac pacemakers.

They received either pelvic floor magnetic stimulation therapy alone or combined with optimized pelvic floor training of YUN between June 2017 and June 2018. Group 1 (the control group) included 46 participants who only received pelvic floor magnetic stimulation therapy. Group 2 (the trial group) included 49 participants who not only received the magnetic stimulation treatment, but also engaged in the optimized pelvic floor training of YUN.

Treatment method

The pelvic floor magnetic stimulation therapy was conducted as follows: the device utilized was the

Magneuro30F magnetic stimulation instrument (Nanjing Vishee Medical Technology Co., Ltd., Nanjing, China). After micturition, the patient sat on the treatment chair and started the treatment protocol for SUI. The magnetic stimulation therapy lasted for 20 min/session, twice a week, to a total of 24 sessions.

The optimized pelvic floor training of YUN is a new type of training method combining PFMT with belly dance movements. The pectineus muscles are exercised indirectly, and the pelvic floor muscles are exercised directly and precisely, with both the fast and slow twitch muscles of the pelvic floor being trained with different rhythm designs. The participants were trained once a day, wearing a metal waist chain weighing 0.8±0.1 kg. The course included 15 min basic warm-up exercises of belly dancing; 25 min contracting the vagina and anus under different conditions, such as hips rolling, dropping, performing figure-8s and shimmy; and 15 min pelvic floor muscle strengthening and systemic relaxation exercises with soothing music.

Therapeutic evaluation

Evaluations were scheduled before the treatment (0 week), after 6 weeks of treatment (6 weeks), and after 12 weeks of treatment (12 weeks). If a participant achieved complete resolution of their urinary incontinence, they were evaluated as cured; a reduction in the occurrence level of SUI but incomplete resolution of urinary incontinence was classified as an improvement; no change indicated invalidity of the treatment; and aggravation was used to describe a worsening of moderate urinary incontinence.

Observation indicators

The clinical efficacy of the two groups at 12 weeks of treatment was compared.

(I) Incontinence related indicators: at 0, 6, and 12 weeks, the improvement of symptoms before and after treatment and between the two groups was compared by recording the number of urine leakages per day, and results of the cough test, and 1 hour pad test.

(II) Urodynamic studies were conducted, including maximum urinary flow rate (Qmax), maximum bladder capacity (MBC), post-void residual volume (PVR), and abdominal leak point pressure (ALPP). After filling the bladder with 300 mL of water, participants were raised to a standing position and the ALPP was recorded by straining (Valsalva maneuver).

(III) The Glazer protocol was used to evaluate the electromyography (EMG) of pelvic floor muscles, and signals were detected using the RAYEE-A Vaginal Probe intravaginal electrode (Nanjing Vishee Medical Ltd., Nanjing, China) and collected with 14-bit accuracy at sampling rate of 2048 Hz using the two-channel EMG device, MyoTrac Infiniti (Thought Technology Ltd., Montreal, QC, Canada). There are five steps to the Glazer protocol: (i) pre-baseline rest; (ii) phasic contraction; (iii) tonic contraction; (iv) endurance contraction; (v) post-baseline rest. The participant was instructed to contract and relax their pelvic floor muscles according to the instructions without contracting the abdominal muscles, adductor muscles, or hip muscles and the EMG value was obtained after the test. The measurement was average peak amplitude (μV) for the phasic contraction and average mean amplitude (μV) for the tonic contraction.

(IV) Questionnaires: the results of International Consultation on Incontinence Questionnaire Short Form (ICI-Q-SF) and Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire-12 (PISQ-12) questionnaires were collected at 0, 6, and 12 weeks. The ICI-Q-SF questionnaire recommended by the ICS allows patients to carefully recall the symptoms of the past 4 weeks, and was designed to assess the level of patients' urinary incontinence. The PISQ-12 questionnaire, designed by Rogers *et al.* in 2001, was used to assess the quality of patients' sexual lives (12). The questionnaire included emotional factors, physiological factors, and sexual partner factors. There are three dimensions and 12 sub-items. The participants filled out the questionnaires themselves.

Statistical methods

Statistical analyses were performed using the software SPSS version 20 (IBM Corp., Armonk, NY, USA). The measurement data were analyzed by *t*-test before and after treatment and were used to compare the differences between the two groups. The statistical description of the counting data was expressed by percentage, and the

Table 1 Participant characteristics at baseline

Characteristics	Group 1 (n=46)	Group 2 (n=49)
Age (years), mean (SD)	37.3 (4.4)	35.8 (5.2)
BMI (Kg/m^2), mean (SD)	25.7 (2.4)	25.2 (2.5)
Duration of disease (months), mean (SD)	27.7 (16.6)	22.2 (13.9)
ALPP, mean (SD)	74.3 (9.3)	74.9 (11.7)

BMI, body mass index; SD, standard deviation; ALPP, abdominal leak point pressure.

Table 2 Comparison of symptoms improvement between the two groups

Follow-up time	0 week			6 weeks			12 weeks		
	Group 1	Group 2	P value	Group 1	Group 2	P value	Group 1	Group 2	P value
Number of urine leakage incidents	3.6 (1.2)	3.9 (1.2)	0.14	1.5 (1.7)[a]	1.3 (1.6)[a]	0.49	1.4 (1.8)[a]	1.1 (1.6)[a]	0.35
1 hour urine pad test (g)	6.6 (1.9)	6.4 (1.9)	0.53	2.6 (2.9)[a]	1.8 (2.7)[a]	0.17	2.3 (3.0)[a]	1.6 (2.7)[a]	0.22
Cough test (participants)	46	49	–	15[a]	20[a]	0.41	18[a]	23[a]	0.44

[a], in the upper right corner represents this data as compared with that before treatment in this group, P<0.05.

χ^2 test was used. If test variables are normally distributed, Statistical significance was considered at P<0.05 (two-tailed test).

Results

Baseline characteristics of the 95 randomized participants were balanced across treatment assignment (*Table 1*). There was no significant difference in age, body mass index (BMI), duration of disease, and ALPP between the two groups (P>0.05).

At 12 weeks of treatment, among the 46 cases in the control group, 18 were cured, 18 were improved, 8 were deemed ineffective, and 2 cases were aggravated. The total effective rate was 78.26%. Among the 49 participants in the trial group, 23 cases were cured, 21 were improved, 4 were deemed ineffective, and 1 case was aggravated. The total effective rate was 89.80%, which was higher than that of the control group.

To compare the improvement of symptoms between the two groups, the number of urine leakages per day, 1 hour urine pad test, and cough test were recorded. It was shown that (*Table 2*) at 6- and 12-week follow up, the number of urine leakages per day, 1 hour urine pad test, and cough test were significantly improved in both groups (P<0.05), while there were no significant intergroup differences at 0, 6, and 12 weeks of treatment (P>0.05).

All participants underwent pelvic floor testing via surface electromyography. *Table 3* shows the pelvic floor EMG values between the trial group and the control group. At 6- and 12-week follow up, phasic contraction EMG values and tonic contraction values were significantly improved in both groups (P<0.05). There were significant differences at each step between the two groups at 6 and 12 weeks after treatment (P<0.05).

Table 4 shows a summary of results of the assessment based on the ICI-Q-SF and PISQ-12 questionnaires. After 6- and 12-week of treatment, the total score of ICI-Q-SF and PISQ-12 in both groups were significantly increased (P<0.05), and the improvement in the trial group was more obvious (P<0.05).

The scores of physiological factors in both groups were significantly increased, while at the level of emotional factors, only the trial group increased after 6 and 12 weeks of treatment (P<0.05). There was no improvement in partner factors in both groups of patients.

Discussion

The findings of this study support that, compared with pelvic floor magnetic stimulation alone, pelvic floor magnetic stimulation combined with optimized pelvic floor training of YUN can further improve the clinical efficiency of female patients with moderate SUI, their pelvic floor

Table 3 Comparison of electromyographic values of the phasic contraction and tonic contraction between the two groups

Follow up	0 week			6 weeks			12 weeks		
	Group 1	Group 2	P value	Group 1	Group 2	P value	Group 1	Group 2	P value
Phasic contraction (μV)	24.1 (2.2)	24.3 (2.4)	0.65	33.5 (5.7)[a]	38.9 (5.4)[a]	0.00	36.6 (5.9)[a]	41.2 (6.2)[a]	0.00
Tonic contraction (μV)	19.0 (2.3)	19.2 (2.5)	0.71	32.7 (6.8)[a]	36.8 (5.2)[a]	0.01	36.0 (6.7)[a]	38.9 (5.5)[a]	0.02

[a], in the upper right corner represents this data as compared with that before treatment in this group, P<0.05.

Table 4 Results of ICI-Q-SF and PISQ-12 scores in two groups

Follow up	0 week			6 weeks			12 weeks		
	Group 1	Group 2	P value	Group 1	Group 2	P value	Group 1	Group 2	P value
ICI-Q-SF score	12.85 (1.619)	13.24 (1.702)	0. 248	5.20 (5.093)[a]	4.43 (4.946)[a]	0. 458	5.93 (5.733)[a]	3.39 (4.873)[a]	0.022
PISQ-12 score	28.83 (3.335)	28.61 (2.745)	0.733	30.63 (3.466)[a]	31.65 (2.955)[a]	0.124	30.24 (3.420)[a]	32.47 (3.076)[a]	0.001
Emotional factors	7.61 (2.038)	7.82 (1.954)	0.613	7.83 (1.877)	8.55 (1.569)[a]	0.043	7.83 (1.877)	8.78 (1.571)[a]	0.009
Physiological factors	14.41 (2.257)	14.37 (2.089)	0.919	15.70 (2.096)[a]	16.84 (2.055)[a]	0.009	15.70 (2.096)[a]	17.24 (2.097)[a]	0.001
Partner factors	6.67 (1.194)	6.43 (1.208)	0.322	6.67 (1.194)	6.27 (1.151)	0.093	6.67 (1.212)	6.45 (1.174)	0.361

[a], in the upper right corner represents this data as compared with that before treatment in this group, P<0.05. ICI-Q-SF, International Consultation on Incontinence Questionnaire Short Form; PISQ-12, Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire-12.

EMG values, and sexual function. The reasons we consider are as follows: (I) by incorporating belly dance into PFMT, optimized pelvic floor training of YUN can significantly improve patient compliance and facilitate a good doctor-patient relationship. Simultaneously, the doctor's careful guidance also fosters patient attention to the ideology of PFMT, and increases the time of home-training between two magnetic stimulation therapies, thereby enhancing the effectiveness of pelvic floor magnetic stimulation therapy. (II) Belly dancing can effectively improve vaginal pressure and adductor muscle strength, thereby improving the symptoms of urinary incontinence (13). Optimized pelvic floor training of YUN was designed to train pelvic floor muscles by incorporating different postures, contracting the pelvic floor muscles rhythmically, improving the motor function and blood circulation of the pelvic floor muscles, promoting the muscle metabolic ability, and then restoring the muscles to the normal dynamic range, thus reducing the occurrence of urinary incontinence. By enhancing pelvic floor muscle strength, vaginal tightness can be improved, while reducing the adverse effects of urinary incontinence on sexual life, thus improving overall sexual function. (III) It has been reported that BMI is an important factor affecting the quality of life of SUI patients (14), with a larger BMI indicating a worse the quality of life. Through general movements, professional and scientific tools can be integrated into a trendy and sexy belly dance to form the innovative method of optimized pelvic floor training of YUN. It can not only exercise the pelvic floor muscle, but also exercise the cross-section, perineum, waist, abdomen, chest, and arms. It can reduce the increase in abdominal pressure caused by obesity through whole-body exercise, thereby improving SUI symptoms and the psychological state of patients.

A recent study showed that treatment of female SUI with pelvic floor magnetic stimulation resulted in significant improvements in multiple sexual dimensions for both partners from both physiological and psychological aspects (15). In the physiological aspect, the sexual function of female SUI patients can be improved by raising pelvic floor muscle strength and SUI symptoms. Psychologically, reducing the fear of urinary incontinence may increase sexual desire, improve vaginal lubrication, and reducing pelvic floor spasm may reduce the incidence of sexual pain. The improvement of urinary incontinence symptoms and sexual function in female SUI patients may engender an improvement of their spouses' sexual function, such as erectile dysfunction and premature ejaculation. This experiment was the first time that pelvic floor magnetic stimulation combined with optimized pelvic floor training of YUN was used to

improve SUI. It has been confirmed again that magnetic stimulation can improve pelvic floor muscle strength, urinary incontinence symptoms, and sexual function of female SUI patients. However, this study did not reach the same conclusion that after combined optimized pelvic floor training of YUN with pelvic floor magnetic stimulation, there were improvements in the sexual function of patients at the psychological level and their spouses' sexual function. As observed in our study, the sexual function of female moderate SUI was further improved by progressively ameliorating the level of physiological factors and emotional factors. However, this study still had its limitations. Due to the short observation time, the long-term efficacy of combined treatment is still unknown and needs further observation and research.

Conclusions

This study found that pelvic floor magnetic stimulation alone or combined with optimized pelvic floor training of YUN are both effective methods for the treatment of female moderate SUI and sexual function, and that their combined use is even more effective. These intervention methods can be effective treatments to decrease SUI symptoms, and have a great impact on physiological and emotional factors in women with SUI.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://tau.amegroups.com/article/view/10.21037/tau-22-222/rc

Data Sharing Statement: Available at https://tau.amegroups.com/article/view/10.21037/tau-22-222/dss

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by ethics board of The Fifth People's Hospital of Shanghai (No. 20180801-1). Informed consent was taken from all the patients.

References

1. Wu JM. Stress Incontinence in Women. N Engl J Med 2021;384:2428-36.
2. Chong EC, Khan AA, Anger JT. The financial burden of stress urinary incontinence among women in the United States. Curr Urol Rep 2011;12:358-62.
3. Wu X, Zheng X, Yi X, et al. Electromyographic Biofeedback for Stress Urinary Incontinence or Pelvic Floor Dysfunction in Women: A Systematic Review and Meta-Analysis. Adv Ther 2021;38:4163-77.
4. Lim R, Liong ML, Leong WS, et al. Patients' perception and satisfaction with pulsed magnetic stimulation for treatment of female stress urinary incontinence. Int Urogynecol J 2018;29:997-1004.
5. Yamanishi T, Suzuki T, Sato R, et al. Effects of magnetic stimulation on urodynamic stress incontinence refractory to pelvic floor muscle training in a randomized sham-controlled study. Low Urin Tract Symptoms 2019;11:61-5.
6. Lim R, Liong ML, Leong WS, et al. Effect of pulsed magnetic stimulation on quality of life of female patients with stress urinary incontinence: an IDEAL-D stage 2b study. Int Urogynecol J 2018;29:547-54.

7. Chang PC, Wu CT, Huang ST, et al. Extracorporeal magnetic innervation increases functional bladder capacity and quality of life in patients with urinary incontinence after robotic-assisted radical prostatectomy. Urological Science 2015;26:250-3.
8. Weber-Rajek M, Strączyńska A, Strojek K, et al. Assessment of the Effectiveness of Pelvic Floor Muscle Training (PFMT) and Extracorporeal Magnetic Innervation (ExMI) in Treatment of Stress Urinary Incontinence in Women: A Randomized Controlled Trial. Biomed Res Int 2020;2020:1019872.
9. Franco MM, Pena CC, de Freitas LM, et al. Pelvic Floor Muscle Training Effect in Sexual Function in Postmenopausal Women: A Randomized Controlled Trial. J Sex Med 2021;18:1236-44.
10. Wang Y, Shi C, Wang Y, et al. Solifenacin combined with optimized pelvic floor training of YUN in treating severe female overactive bladder: a prospective randomized controlled trial. Chinese Journal of New Drugs and Clinical Remedies 2017;36:657-62.
11. Lim R, Liong ML, Leong WS, et al. Treatment satisfaction and patients' perception of pulsed magnetic stimulation for female stress urinary incontinence. European Urology Supplements 2016;3:e4.
12. Rogers RG, Kammerer-Doak D, Villarreal A, et al. A new instrument to measure sexual function in women with urinary incontinence or pelvic organ prolapse. Am J Obstet Gynecol 2001;184:552-8.
13. An SY, Kim SS, Han G. Effect of belly dancing on urinary incontinence-related muscles and vaginal pressure in middle-aged women. J Phys Ther Sci 2017;29:384-6.
14. Falah-Hassani K, Reeves J, Shiri R, et al. The pathophysiology of stress urinary incontinence: a systematic review and meta-analysis. Int Urogynecol J 2021;32:501-52.
15. Lim R, Liong ML, Lau YK, et al. Effect of Pulsed Magnetic Stimulation on Sexual Function in Couples With Female Stress Urinary Incontinence Partners. J Sex Marital Ther 2018;44:260-8.

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