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A Retrospective Cohort Study Comparing Magnetic-Electric Combined Stimulation to Single Electrical Stimulation for Treating Female Stress Urinary Incontinence

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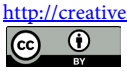


Abstract

Objective: To investigate the therapeutic effects of combined magnetic and electrical stimulation in treating female stress urinary incontinence (SUI) and to develop a more effective and optimized treatment plan for SUI patients. Methods: A retrospective analysis was conducted involving 102 patients with SUI who were admitted from May 2022 to June 2024. The treatment methods were categorized into two groups: those receiving combined magnetic and electrical stimulation (study group, n = 54) and those receiving electrical stimulation alone (control group, n = 48). Changes in Glazer's pelvic floor surface electromyography (EMG) assessments, results from a 1-hour pad test, and outcomes from cough tests were compared before and after treatment, along with the effective rates for each group. Results: There were no statistically significant differences in the EMG values during the resting phase, as well as for type I and type II muscle fibers, before treatment between the two groups (all $P > 0.05$), indicating that the groups were comparable. After treatment, the EMG values for the resting phase decreased and both muscle fiber types were higher than before in both groups ($P < 0.05$), with the study group showing values closer to the normal range than the control group ($P < 0.05$). There was no significant difference in urine leakage between the 1 hour pad test and cough test before treatment ($P > 0.05$). After treatment, the urine leakage of the two groups was reduced to varying degrees ($P < 0.001$), and the urine leakage in the study group was closer to the normal range than that in the control group ($P < 0.001$). After treatment, the cough test was negative in both groups, and the difference between the two groups was statistically significant ($P <$

0.001). Additionally, the effective rate of treatment in the study group was higher than that in the control group (P = 0.03). Conclusion: For patients experiencing stress urinary incontinence, pelvic floor rehabilitation that combines magnetic and electrical stimulation has shown positive results in clinical practice. This integrated approach significantly reduces symptoms and holds potential for wider application. Both the combined therapy and electrical stimulation alone have demonstrated measurable symptom relief.

Keywords

Stress Urinary Incontinence, Combined Magnetic and Electrical Stimulation, Electrical Stimulation, Pelvic Floor Rehabilitation Therapy, Pelvic Floor Muscle Glazer

1. Introduction

Stress urinary incontinence (SUI) occurs when urine leaks involuntarily due to increased abdominal pressure caused by actions such as coughing, sneezing, or exercising. According to relevant reports, the overall incidence of SUI among adult women in China is 18.9% with the highest rate of 28.2% found in women aged 50 to 59 [1] [2]. The exact mechanism behind SUI is still unclear, but it is known that pregnancy, childbirth, and decreased estrogen levels are independent risk factors. This condition significantly impacts patients' quality of life, psychological well-being, social life, and emotions. Additionally, the severity of SUI varies among individuals. Mild cases typically occur only during certain activities, while severe cases may also happen at rest.

According to the report in 2023, managing SUI requires individualized treatment, which may include psychological interventions, lifestyle changes, and other multidimensional approaches to achieve optimal clinical outcomes [3]. The 2021 Polish guidelines for urogynecology emphasize that conservative treatment should be the first choice, regardless of the severity of SUI symptoms [4]. If conservative therapy is ineffective or if symptoms worsen with a poor prognosis, a surgical assessment should be recommended. Conservative treatment options for SUI include lifestyle changes (such as weight loss and quitting smoking), Kegel exercises, physical factor therapy (including electrical stimulation, radiofrequency ablation, and combined magnetic and electrical therapy), and pharmacological treatments.

In recent years, magnetoelectric combined therapy has gained attention as a treatment approach due to its non-invasive nature and excellent tolerance. The therapy boasts a high satisfaction rate, with most patients not experiencing serious complications. Only a few have reported mild local muscle tingling. Therefore, the effectiveness and safety of magnetoelectric combined therapy merit further investigation.

2. Materials and Methods

2.1. General Information

This study involved a retrospective analysis of 102 patients with Stress Urinary Incontinence (SUI) who were admitted to our department between May 2022 and June 2024. The research protocol received approval from the hospital's ethics committee (Approval No.: 2025-484-01). The treatment methods were categorized into two groups: the study group, which received combined magnetic and electrical therapy (n = 54), and the control group, which received electrical stimulation alone (n = 48). A comparison of general data, including age, mode of delivery, parity, body mass index, and the presence of chronic diseases (such as hypertension, diabetes, and chronic cough), revealed no statistically significant differences between the two groups (P > 0.05, Table 1), indicating that the groups were comparable.

Table 1. General information.

General information		Magnetic and electrical combined group (n = 54)	Electrical stimulation group (n = 48)	t	P value
Age		47.50 ± 9.465	49.14 ± 9.101	−0.898	0.372
BMI		23.522 ± 2.3531	24.173 ± 2.4291	−1.379	0.171
Mode of delivery	C-sect	7 (12.96%)	4 (8.16%)	0.219	0.640
	Eutocia	47 (87.04%)	45 (91.84%)		
Chronic disease	Hypertension	2 (3.70%)	2 (4.08%)	0.258	0.879
	Diabetes mellitus	2 (3.70%)	1 (2.04%)		
	Not have	50 (92.60%)	46 (93.88%)		
Parity	1	30 (55.56%)	34 (69.39%)	3.899	0.273
	2	21 (38.89%)	13 (26.53%)		
	3	3 (5.55%)	1 (2.04%)		
	4	0 (0.00%)	1 (2.04%)		

2.2. Inclusion and Exclusion Criteria

All subjects who meet the inclusion criteria and do not meet any of the exclusion criteria can be enrolled in the study group. Inclusion criteria for the study were as follows: meeting the International Continence Society (ICS) diagnostic criteria for stress urinary incontinence (SUI); age 20 - 60 years; no prior pelvic floor rehabilitation or SUI surgery; no history of pelvic surgery or radiotherapy; and willingness to comply with the study protocol and follow-up requirements. Exclusion criteria include: presence of urinary tract infection, vaginitis, or acute pelvic inflammatory disease; known or suspected malignancy; pelvic organ prolapse (POP-

Q score greater than Grade II); pregnancy; body mass index (BMI) greater than 27; abnormal uterine bleeding; presence of a metallic intrauterine device (IUD) or metallic implant; failure to meet inclusion criteria.

2.3. Method

2.3.1. Electrical Stimulation Group

The treatment involves 20 minutes of electrical stimulation followed by 10 minutes of biofeedback. After the patient has urinated and defecated, they lie supine with their hips and knees flexed. A physician from the hospital's pelvic floor center applies lubricating gel to the electrical stimulation probe and gently inserts it into the patient's vagina.

Electrode pads are placed on the skin at the right anterior superior iliac spine and on the lower abdomen. The intensity of the electrical stimulation is adjusted based on the results of the patient's pre-treatment pelvic floor function assessment. It begins at 0 - 10 mA in the initial phase and increases to 10 - 35 mA during the treatment phase, with the maximum intensity not exceeding 35 mA. Each treatment session lasts for 20 minutes.

Following the electrical stimulation, the biofeedback treatment is conducted. The treatment system is activated, and the patient engages in training to develop type I and type II muscle fibers of the pelvic floor muscles, guided by graphic and voice prompts displayed on the screen.

This treatment is administered 2 - 3 times a week for six consecutive weeks. After six weeks, another pelvic floor function assessment is performed. The normal ranges for the resting period are 2 - 4 μV, for type I muscle fibers 10 - 30 μV, and for type II muscle fibers 30 - 50 μV.

2.3.2. Combined Magnetic and Electrical Stimulation Group

The treatment involved 20 minutes of alternating magnetic and electrical stimulation, followed by 10 minutes of biofeedback. The MLD FL100 magnetic stimulation device was utilized, featuring a pulse width of 340 microseconds, a maximum magnetic induction intensity of 8T, and a frequency range of 0 - 100 Hz. After the patient had urinated and defecated, they sat directly on the treatment chair without needing to undress. The chair was adjusted so that the center of the magnetic stimulation coil was positioned directly over the patient's sacrococcygeal region. The magnetic stimulation treatment commenced with a low frequency of 1 - 5 Hz for 45 seconds, followed by a 5-second rest. The intensity was gradually increased based on the patient's subjective sensations, reaching up to 50 Hz, which was then maintained for 10 minutes. After a 10-minute rest, electrical stimulation was administered for an additional 10 minutes in an alternating manner. The electrical stimulation and biofeedback methods were consistent with the previously described protocols, with each treatment lasting 30 minutes and scheduled for 2 - 3 times a week over six consecutive weeks. After the six-week treatment period, a follow-up assessment of pelvic floor function was conducted using the same reference indicators as before.

2.3.3. Correct Method for 1-Hour Pad Test

Participants should avoid menstruation during testing. Before the test, empty the bladder and prepare pre-weighed sanitary pads and 500 ml of warm water. The entire test lasts one hour. Procedure: Drink 500 ml of warm water within 15 minutes before the test. Within the next 30 minutes, perform walking and stair climbing activities. In the final 15 minutes, complete the following: stand up and sit down 10 times, cough deeply 10 times, jog for 1 minute, bend over to pick up five items from the ground, and finally wash hands under running water for 1 minute. After the test, remove the pad and have the doctor weigh and record its weight, comparing it to a clean pad. Results are classified as follows: Urine leakage < 1 g: Mild abnormality 1 - 5 g: Mild leakage 5 - 10 g: Moderate leakage 10 - 50 g: Severe leakage > 50 g: Extreme leakage.

2.3.4. Cough Test Method

The subject should empty their bladder, then assume a supine position with knees bent and hips flexed. After coughing 1 - 2 times consecutively, observe whether urine leaks from the urethral opening during the coughing phase: leakage indicates a positive result, while no leakage indicates a negative result.

2.3.5. Grouping Basis

Patient allocation was non-randomized and based on a standardized clinician assessment protocol and the patients' right to choose. The treatment was determined through clinical assessment by two experienced gynecologists: 1) fully informed of the efficacy and risk of each treatment plan, respecting the patient's choice of treatment plan, 2) the doctors in the pelvic floor center of our hospital formulated the treatment plan based on the patients' symptoms and pelvic floor evaluation results, and excluded the contraindications of each plan, 3) the development and availability of equipment in our hospital.

The monitoring and grading of Adverse Events were based on "Common Terminology Criteria for Adverse Events, CTCAE" [5], and the criteria were as follows: Mild (Grade 1): Symptoms were mild, did not interfere with the patient's daily activities, did not affect the implementation of the treatment plan, and no additional intervention was required. Common manifestations include: temporary redness of the skin at the treated area (lower abdomen, perineum) (lasting less than 24 hours and can subside on its own), and a mild feeling of soreness and distension in the lower abdomen (relieved after rest). Moderate (Grade 2): Symptoms can interfere with some of the patient's daily activities, but the patient can still tolerate them and complete the prescribed treatment cycle. Local symptomatic treatment or adjustment of treatment parameters is required. Common manifestations include: redness, swelling, and itching of the skin at the treatment site (lasting more than 24 hours, with the need for external emollient relief), and distension and pain in the lower abdomen (treatment can continue after reducing the intensity of stimulation or shortening the duration of a single treatment session). Severe (Grade 3): Symptoms seriously interfere with the patient's daily activities, forcing treatment to be interrupted or terminated, and medical interven-

tion (such as drug treatment, local wound management) is required. Common manifestations include: skin damage at the treatment site, blisters (treatment needs to be terminated and anti-inflammatory ointment applied externally), vaginal burning pain (gynecological examination is required after drug withdrawal to rule out mucosal damage).

2.4. Observation Indicators

Multiple indicators were used for evaluation: 1) Glazer assessment of pelvic floor muscles: pre-resting period, type I/II slow muscle fibers, type I slow muscle fibers, post-resting period, comparing the results of pelvic floor muscle electromyography values before and after treatment in both groups. 2) Comparison of 1-hour pad test and cough test results. 3) Evaluation of subjective efficacy. 4) Cure was defined as a 24-hour pad weight gain of less than 1 g and a negative cough test, and the patient subjectively felt no leakage. Remission was defined as a reduction in leakage volume of more than 50%, but still more than 1 g. Ineffective was defined as a reduction in leakage volume of less than 50% or an increase.

2.5. Statistical Methods

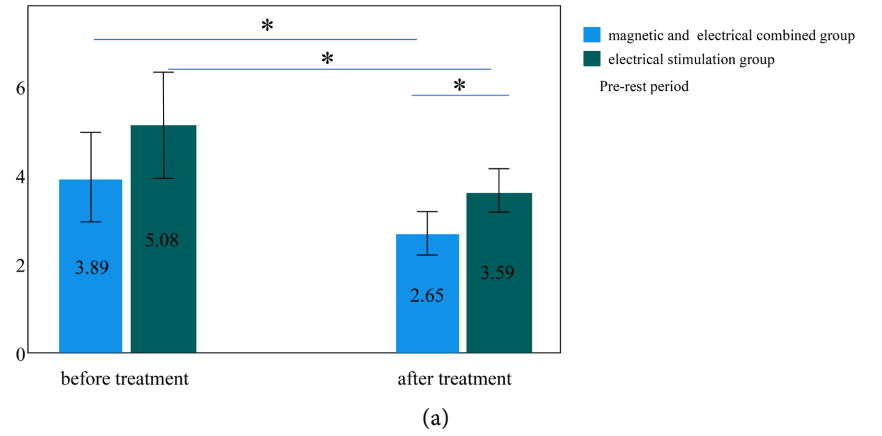
Data were processed using SPSS version 26.0. The normal distribution of measurement data was tested using the Shapiro-Wilk test, while the Levene test assessed the homogeneity of variance. Variables that followed a normal distribution were expressed as mean ± standard deviation ($x \pm s$), and a paired sample t-test was used for comparisons. Variables that did not conform to a normal distribution were expressed as median [P25 - P75] and analyzed using a non-parametric test. Categorical variables were expressed as numbers and percentages (%) and analyzed using the χ^2 or Fisher's exact test. A two-sided P value of less than 0.05 was considered statistically significant.

3. Results

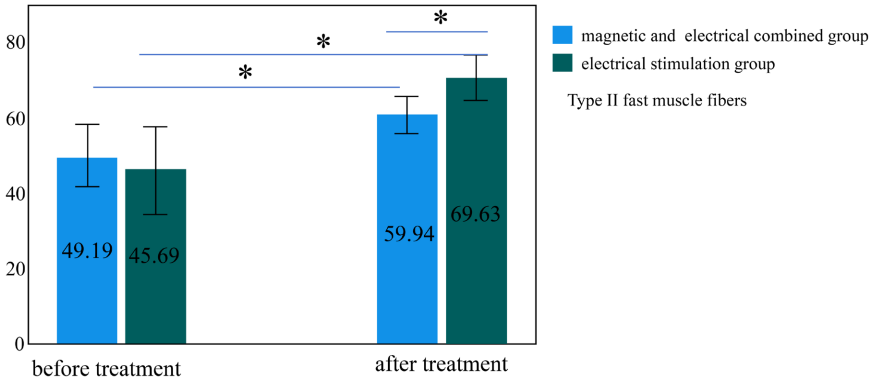
3.1. Comparison of Glazer Assessment Results of Pelvic Floor Muscles before and after Treatment in Patients

Before treatment, there were no statistically significant differences between the resting phase, type I, and type II muscle fiber electromyography values of the two groups (all $P > 0.05$), indicating that the groups were comparable. After treatment, the Glazer values for the pelvic floor muscles in the magnetoelectric combination group were closer to the normal range than those in the electrical stimulation group, with statistically significant differences observed (all $P < 0.05$).

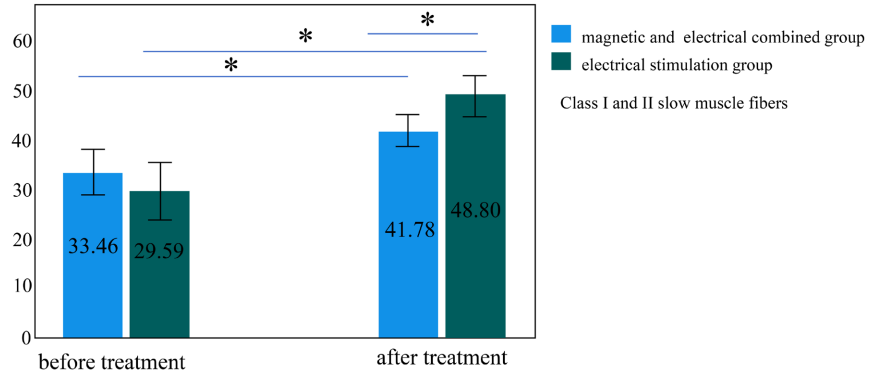
Within each group, the surface electromyography values of the pelvic floor muscles during the resting phase decreased after treatment compared to before treatment, showing statistically significant differences ($P < 0.05$). Additionally, the electromyography values for type I and type II muscle fibers increased after treatment in both groups, also with statistically significant differences ($P < 0.05$). Please refer to Table 2 and Figure 1 for more details.


magnetic and electrical combined group
electrical stimulation group
Pre-rest period
6
4
2
0
3.89
5.08
2.65
3.59
before treatment
after treatment

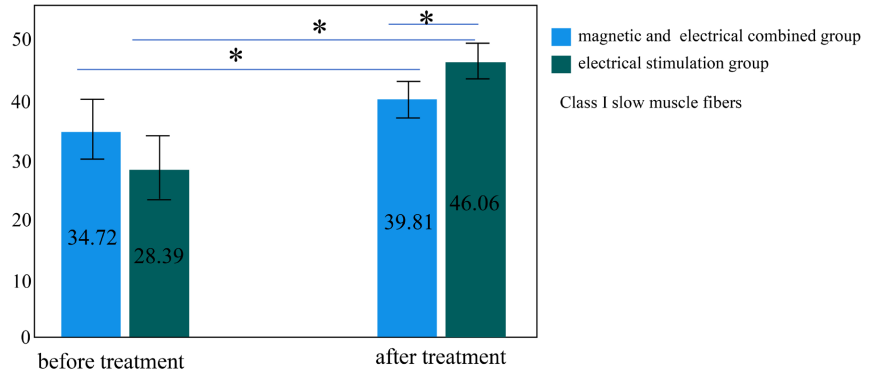
(a)


magnetic and electrical combined group
electrical stimulation group
Type II fast muscle fibers
80
60
40
20
0
49.19
45.69
59.94
69.63
before treatment
after treatment

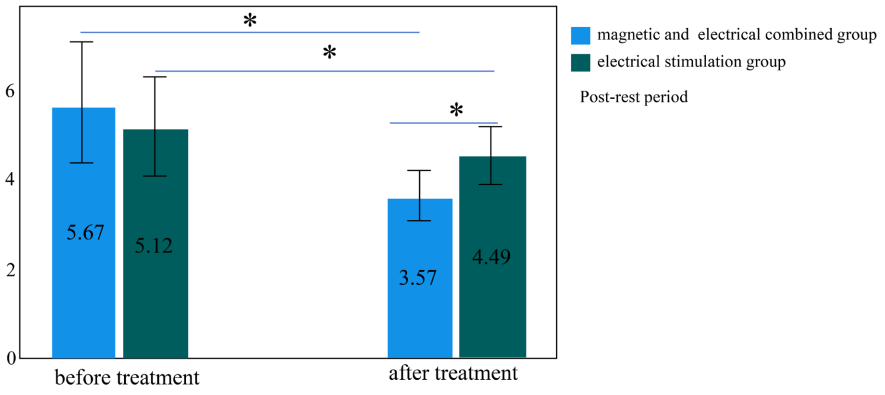
(b)


magnetic and electrical combined group
electrical stimulation group
Class I and II slow muscle fibers
60
50
40
30
20
10
0
33.46
29.59
41.78
48.80
before treatment
after treatment

(c)


magnetic and electrical combined group
electrical stimulation group
Class I slow muscle fibers
50
40
30
20
10
0
34.72
28.39
39.81
46.06
before treatment
after treatment

(d)



(e)

Figure 1. Comparison of electromyography values after different treatments. Note 4: Comparison of EMG before and after combined magnetoelectric and electrical stimulation. (a): The pre-resting period of both groups decreased after treatment compared to before treatment, but the combined magnetoelectric treatment was closer to the normal range. (b): The type II fast muscle fibers of both groups increased after treatment compared to before treatment, but the combined magnetoelectric treatment was closer to the normal range. (c): The type I and type II slow muscle fibers of both groups increased after treatment compared to before treatment, but the combined magnetoelectric treatment was closer to the normal range. (d): The type I slow muscle fibers of both groups increased after treatment compared to before treatment, but the combined magnetoelectric treatment was closer to the normal range. (e): The post-resting period of both groups decreased after treatment compared to before treatment, but the combined magnetoelectric treatment was closer to the normal range. *P < 0.05.

Table 2. Glazer assessment results of pelvic floor muscles (rV, Mean ± SD).

Measuring indicators	Test groups (mean ± standard deviation)		t	P value
	Magnetic and electrical combined group (n = 54)	Electrical stimulation group (n = 48)		
Pre-rest period before treatment	3.89 ± 3.63	5.08 ± 4.22	−1.542	0.126
After pre-sedation therapy	2.65 ± 1.91	3.59 ± 1.55	−2.729	0.007
t	2.22	2.903		
P value	0.029	0.005		
Type II fast muscle fibers before treatment	49.19 ± 29.87	45.69 ± 38.52	0.517	0.607
After treatment of class II fast muscle fibers	59.94 ± 18.23	69.63 ± 20.05	−2.569	0.012
t	−2.259	−2.962		
P value	0.026	0.004		
Class I and II slow muscle fibers before treatment	33.46 ± 17.14	29.59 ± 20.49	1.044	0.299

Continued

Class I and Class II slow muscle fibers after treatment	41.78 ± 11.12	48.80 ± 14.05	−2.823	0.006
t	−2.991	−3.809		
P value	0.004	<0.001		
Class I slow muscle fibers before treatment	34.72 ± 18.29	28.39 ± 18.46	1.748	0.084
Class I slow muscle fibers after treatment	39.81 ± 11.30	46.06 ± 9.58	−3.011	0.003
t	−1.741	−4.08		
P value	0.085	<0.001		
Post-rest period before treatment	5.67 ± 4.83	5.12 ± 3.83	0.629	0.53
Post-rest period after treatment	3.57 ± 2.03	4.49 ± 2.17	−2.21	0.029
t	2.937	2.411		
P value	0.004	0.019		

3.2. Comparison of 1-Hour Urine Pad Leakage Volume Test and Cough Test

There was no significant difference in urine leakage between the 1 hour pad test and cough test before treatment (P > 0.05). After treatment, the urine leakage of the two groups was reduced to varying degrees (P < 0.001), and the urine leakage in the study group was closer to the normal range than that in the control group (P < 0.001). After treatment, the cough test was negative in both groups, and the difference between the two groups was statistically significant (P < 0.001). Please refer to Table 3, Table 4, and Figure 2 for more details.

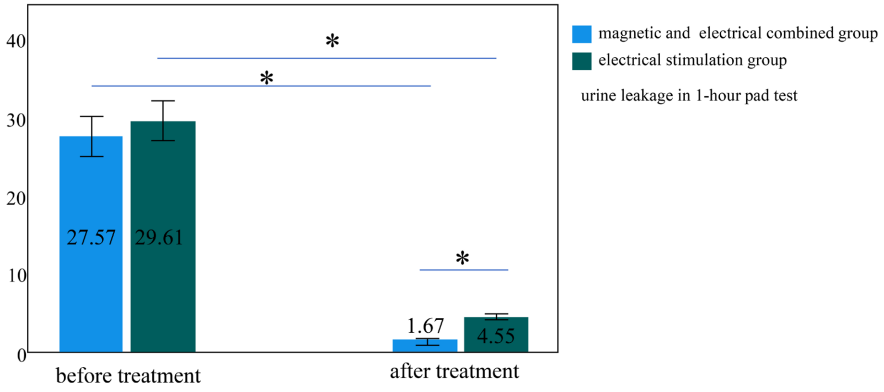


Figure 2. Comparison of urine leakage in 1-hour pad test. Note 4: Comparison of urine pad test 1 h before and after combined magnetoelectric and electrical stimulation. Figure 2: The urine leakage volume of the two groups decreased to varying degrees after treatment compared with that before treatment, and the combined magnetoelectric treatment was closer to the normal range. *P < 0.05.

Table 3. Comparison of urine leakage volume in 1-hour urine pad test.

Group	Treatment groups (mean ± standard deviation)		t	P value
	Pretherapy	Post-treatment		
magnetic and electrical combined group (n = 54)	27.57 ± 9.51	1.67 ± 0.61	19.969	<0.001
electrical stimulation group (n = 48)	29.61 ± 8.76	4.55 ± 0.94	19.917	<0.001
t	−1.127	−18.28		
P value	0.262	<0.001		

Table 4. Cough test.

Group	Category	Pretherapy	Post-treatment	X^2	P value
magnetic and electrical combined group (n = 54)	positive rate (%)	44 (81.4)	0 (0.00)	74.250	<0.001
	negative rate (%)	10 (18.5)	54 (100.0)		
electrical stimulation group (n = 48)	positive rate (%)	42 (87.5)	0 (0.00)	73.500	<0.001
	negative rate (%)	6 (12.5)	48 (100.00)		
X^2		0.334	-		
P value		0.563	-		

3.3. Comparison of Effective Rates before and after Treatment for Patients

According to the subjective efficacy evaluation criteria, urinary incontinence symptoms were alleviated in both treatment groups compared to their status before treatment. The comparison of cure rates revealed that the group receiving combined magnetic and electrical stimulation had a higher cure rate than the group receiving only electrical stimulation, with a statistically significant difference (P = 0.03). Specifically, the cure rate for the combined magnetic and electrical stimulation group was 1.7 times greater than that of the electrical stimulation group (Relative Risk [RR] = 1.7, 95% Confidence Interval [CI] 1.1 - 2.8). Please refer to Table 5 for additional details.

Table 5. Comparison of cure rate and total effective rate after treatment (Cases, %).

Group	n	Cure	Laxation	Of no avail	Always effective	Cure rate	Total effective rate
electrical stimulation group (n = 48)	48	16	22	10	38	33.3%	79.1%
magnetic and electrical combined group (n = 54)	54	32	14	8	46	59.2%	85.1%
chi-square/Z						7.099	7.005
P value						0.029	0.030

3.4. Outcomes of the Two Groups

A total of 168 patients with stress urinary incontinence (SUI) received treatment. Among these, 42 patients were unable to attend the hospital for pelvic floor rehabilitation due to the epidemic, and 13 patients were excluded based on the inclusion and exclusion criteria. 61 patients received combined magnetic and electrical stimulation treatment, but 7 were lost to follow-up. Among the 54 patients who completed the treatment, 9.3% underwent surgery, and 9.3% developed complications. Additionally, 52 patients received electrical stimulation treatment, with 4 lost to follow-up. Of the 48 patients who completed this treatment, 14.6% underwent surgery, and 10.4% developed complications. Please refer to Figure 3.

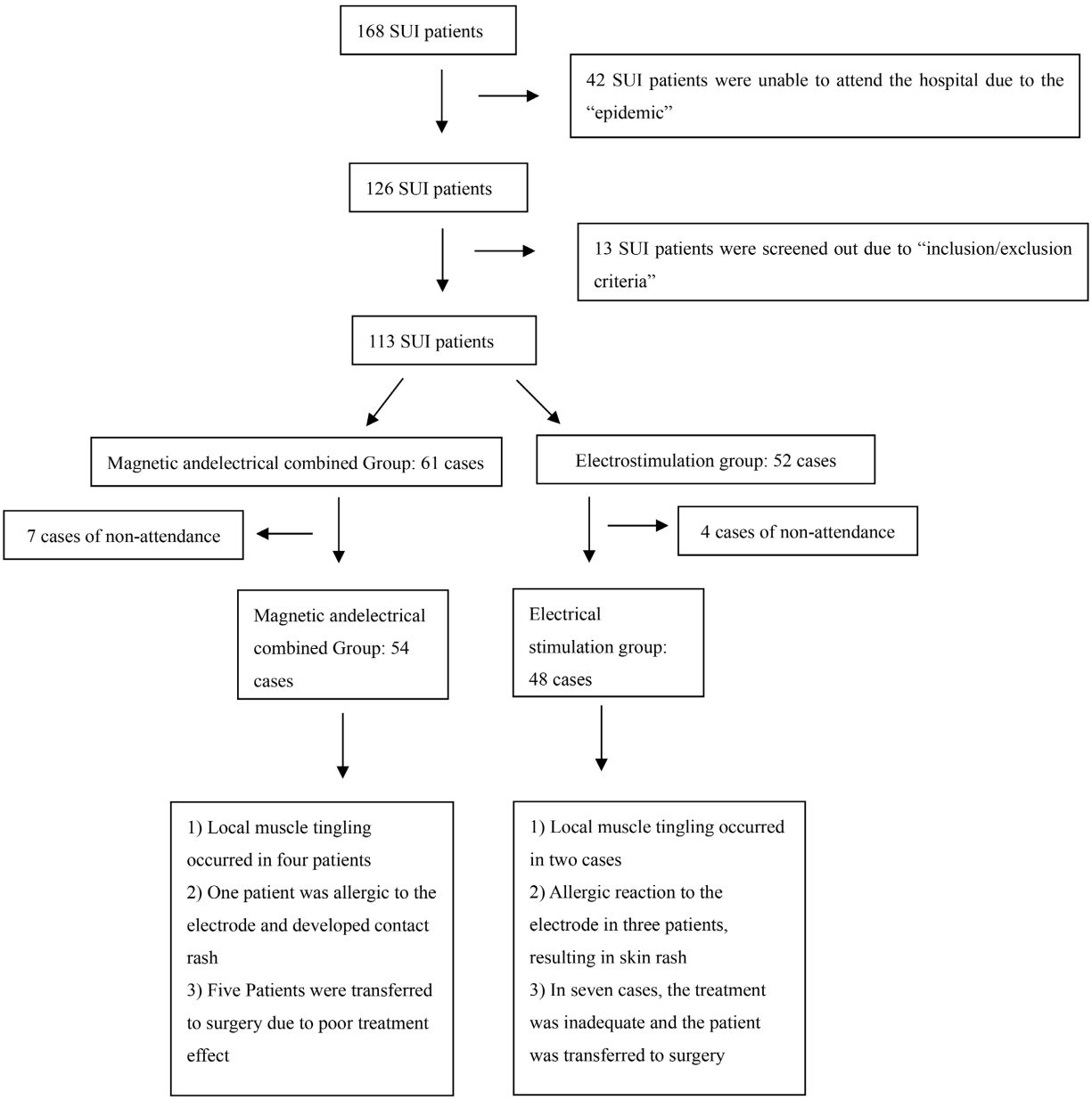


Figure 3. Distribution of treatments for stress urinary incontinence.

Safety Evaluation

No serious adverse events (SAEs) occurred during this study. A total of 10 adverse events were reported in the combined groups of magnetoelectric and electrical stimulation, all of which were mild to moderate in nature. The most commonly reported issue was local muscle pain, with 6 cases (5.9%), followed by skin rashes or allergic reactions to the electrode patches, which accounted for 4 cases (3.9%). All adverse events were alleviated with symptomatic treatment, and no participants withdrew from the study. Additionally, there were 12 cases (5 from the magnetoelectric group and 7 from the electrical stimulation group) that required conversion to surgical treatment due to poor therapeutic effects. According to the WHO-UMC causality criteria, these cases were determined to be "probably unrelated" to the treatments. For further details, please refer to Table 6.

Table 6. Summary of adverse events.

Adverse event	Magnetic and electrical combined Group (n = 54)	Electrical stimulation group (n = 48)	Total (n = 102)	Relationship to therapy*	Treatment measure	Whether to withdraw from research
Local muscle tingling	4 (7.4%)	2 (4.2%)	6 (5.9%)	Probably relevant	Reduced intensity, no discontinuation of medication	deny
Skin rash/allergy	1 (1.9%)	3 (6.3%)	4 (3.9%)	Probably relevant	Change the electrode and apply calamine externally	deny
Surgery after ineffective treatment	5 (9.3%)	7 (14.6%)	12 (11.8%)	It may not matter	Referring to the urology department for TVT-O	yes

4. Discussion

The treatment of stress urinary incontinence (SUI) is essential for the physical and mental well-being of women. A tailored approach is implemented to address individual differences and create a systematic treatment plan. The variety of treatment methods has significantly enhanced their effectiveness [6].

In a study conducted by Han *et al.*, 100 patients with SUI were analyzed. The results indicated that the total effective rate of combined magnetic and electrical stimulation was 92.0%, with a cure rate of 56.0% [7]. Both rates were higher than those achieved with single electrical stimulation treatment. Some scholars have reported the combined therapy effectively relieved urinary incontinence in approximately 43.0% or 43.7% [8] [9]. Furthermore, others reported a cure rate of

46% or 52.9% for combined magnetoelectric therapy [10] [11]. In our study, we found that the cure rate for this combined treatment was 59.2%, while the effective rate was 85%. These figures are consistent with findings from both domestic and international studies, highlighting that research on combined magnetic and electrical stimulation is valuable. This treatment not only provides effective clinical outcomes but also enhances patients' quality of life.

Studies have shown that the therapeutic mechanism of combined magnetic and electrical treatment involves the direct stimulation of pelvic floor muscles and sacral nerves [12] [13]. This approach improves local blood circulation, enhances the contractile function of the muscles, and strengthens the neural innervation of the pelvic floor. As a result, it provides better support for the urethra and improves its closure ability, which alleviates symptoms of urinary incontinence in patients. In the research conducted by some scholars, the details of this combined treatment mechanism were thoroughly explained, and an experimental analysis was designed to support it [14]-[16]. This treatment effectively integrates the benefits of both electrotherapy and magnetotherapy, utilizing the non-invasive and convenient modality of magnetotherapy. Specifically, it induces changes in the electric field through a targeted frequency and intensity of the magnetic field. After adjustment, an effective electric field stimulation can be generated within the body, focusing on the nerves and regulating the sacral nerve. The frequency range is generally between 1 and 1000 Hz. Low-frequency magnetic fields can regulate the membrane potential of cells, accelerate cell metabolism and repair processes, allowing damaged pelvic floor muscle tissue to heal. The electric field stimulation induced by the magnetic field improves blood circulation in the pelvic floor, enhances oxygen supply to local tissues, and further strengthens the strength and neural innervation of the pelvic floor muscles. This approach allows for precise diagnosis of pelvic floor muscles through electrostimulation and biofeedback. It also incorporates interferential current therapy using multiple frequencies. Here, a high-frequency base current (around 4000 Hz) and a low-frequency modulating signal (approximately 100 Hz) interfere with each other to stimulate damaged pelvic floor muscles, thereby increasing muscle contractility and endurance and achieving a deep therapeutic effect.

Domestic and foreign reports believe that the combined action of both therapies addresses the challenge of insufficient activation of superficial nerves through magnetic stimulation and compensates for the limited penetration depth of electrical stimulation [17]-[19]. Moreover, it allows for a stepwise training effect of "activation first, then strengthening," making it easier to achieve the necessary "sufficient strength and lasting endurance" for urinary control of the pelvic floor muscles compared to single stimulation methods. As a result, this method maximizes the repair of damaged pelvic floor muscles, enhances neural innervation, and improves urinary control ability.

This study indicates that among the patients monitored during follow-up, there was no significant recurrence of urinary incontinence episodes, urine volume issues, or subjective symptoms within six months after completing treatment in the

study group. In contrast, only a few patients in the control group maintained a stable condition. Additionally, the results from the Glazer test assessing pelvic floor muscles and the one-hour pad test, along with the negative rates and effective rates from the cough test post-treatment, combined with the report of other scholars suggest that the combined magnetic and electrical stimulation group may have a better therapeutic effect compared to the electrical stimulation group alone [20] [21]. In conclusion, magnetic and electrical combined therapy and electrical stimulation therapy produce similar therapeutic effects on the pelvic floor muscles. However, only 9.3% of cases requiring surgery were associated with magnetic and electrical combined therapy, and this treatment also showed lower complication rates compared to single electrical stimulation therapy. Additionally, the effective rate and cure rate indicate that magnetic and electrical combined therapy is superior to electrical stimulation therapy.

In a study conducted by Zhu *et al.* combined with this study suggests that magnetic and electrical combined therapy has distinct advantages in symptom improvement, quality of life enhancement, and tolerance increase, making it suitable for widespread application [22]. Currently, the market price for magnetic and electrical combined therapy equipment in China is 750,000 yuan, and the cost for one treatment course is approximately 4000 yuan, which is higher than that of single electrical stimulation therapy. A further cost-effectiveness analysis is necessary to provide more accurate data for promoting this treatment at the grassroots level.

This study has several limitations: This study is a single-center small-sample study. The results cannot fully represent the situation of patients with stress urinary incontinence. The follow-up period is only six months, which is not sufficient to fully assess the recurrence risk and long-term efficacy. According to the 2024 CUA guidelines for women with stress urinary incontinence [23], the recurrence rate of pelvic floor rehabilitation treatment without adherence is as high as 30% - 50%. The recurrence rate is 10% to 20%. Moreover, there is a lack of objective indicators to support it. Therefore, in the future, the follow-up period should be extended and the detection methods should be improved. Further verification of the stability and reliability of the combined magnetic-electric treatment should be conducted in larger samples and prospective studies.

5. Conclusion

The combination of magnetic and electrical stimulation therapy has demonstrated significant therapeutic benefits when applied to patients with stress urinary incontinence, effectively alleviating symptoms and yielding favorable rehabilitation outcomes, thus indicating substantial potential for clinical use. Both the combined magnetic-electrical approach and electrical stimulation alone have been shown to provide varying degrees of symptom improvement. However, given the current limitations in sample size and study duration, further large-scale, long-term follow-up clinical studies are required to validate the stability, durability, and overall reliability of the combined magnetic and electrical stimulation therapy.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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