

Analysis of Urinary Conditions and Effects of Pelvic Floor Muscle Electrical Stimulation Combined with Biofeedback Therapy in Women with Stress Urinary Incontinence

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Abstract: *Objective:* To analyze the urinary conditions and assess the effects of pelvic floor muscle electrical stimulation combined with biofeedback treatment in female patients with stress urinary incontinence. *Methods:* 80 patients with stress urinary incontinence admitted to Haimen District Traditional Chinese Medicine Hospital from March 2023 to September 2023 were included as the research subjects. Following the principle of random grouping, they were divided into an observation group and a control group. Patients in the control group received single pelvic floor muscle electrical stimulation treatment, while patients in the observation group underwent pelvic floor muscle electrical stimulation combined with biofeedback. The treatment effects, pelvic floor muscle strength, quality of life, and any adverse reactions in both groups were analyzed. *Results:* The total effective rate of patients undergoing combined treatment was significantly higher ($P < 0.05$) compared to the control group with a single treatment. While there was no significant difference in the pelvic floor muscle data between the observation and control groups before treatment, after treatment, the data in the observation group showed a significant increase ($P < 0.05$). Before treatment, there was no statistical difference in quality of life data between the two groups ($P > 0.05$), but after treatment, the quality of life score in the observation group was significantly higher ($P < 0.05$). No adverse reactions were reported in either group during the treatment process. *Conclusion:* Pelvic floor muscle electrical stimulation combined with biofeedback can effectively improve urinary leakage in patients with stress urinary incontinence, demonstrating a relatively ideal clinical effect. Furthermore, this combined treatment can enhance pelvic floor muscle condition, improve quality of life, and effectively safeguard the physical and mental health of female patients.

Keywords: Pelvic floor muscle electrical stimulation; Biofeedback therapy; Stress urinary incontinence; Urination status

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1. Introduction

Stress urinary incontinence significantly impacts the physical and mental well-being of female patients. In contemporary society, with the progression of aging and escalating social pressures, the prevalence of stress urinary

incontinence continues to rise annually ^[1]. Some researchers posit that the incidence of this condition in women over 60 years old exceeds 50% ^[2]. Consequently, effective treatment has become the focal point of clinical research.

For the clinical management of stress urinary incontinence, the primary approaches encompass surgical and non-surgical interventions. Non-surgical treatments, including pelvic floor muscle training, biofeedback therapy, and electrical stimulation therapy, are widely employed. While each method individually can yield positive outcomes, their standalone effectiveness may fall short of achieving ideal results. Hence, there is a recognized need for combined treatment approaches ^[3].

Against this backdrop, this study aims to analyze the urination conditions and the impact of pelvic floor muscle electrical stimulation combined with biofeedback treatment in women with stress urinary incontinence. Over the period from March 2023 to September 2023, the study involved 80 patients diagnosed with stress urinary incontinence.

2. Materials and methods

2.1. General information

Eighty patients diagnosed with stress urinary incontinence and admitted to Haimen District Traditional Chinese Medicine Hospital from March 2023 to September 2023 constituted the research subjects. Inclusion criteria were as follows: (1) All 80 patients had a history of childbirth; (2) Normal cognitive abilities were observed in all patients; (3) Patients experienced mild to moderate stress urinary incontinence; and (4) Clinical manifestations included varying degrees of urinary incontinence during activities such as fast running and jumping, necessitating the use of urinary pads. Exclusion criteria comprised: (1) Previous pelvic or urethral surgeries; (2) History of head injuries and surgeries; (3) Presence of urinary system infection; (4) History of diabetes and liver or kidney dysfunction; and (5) Contraindications to treatment. All patients have given consent to participate in this study. Applying the principle of random grouping, patients were divided into an observation group and a control group. No statistically significant differences were observed in the clinical data of the two groups, as presented in **Table 1**.

Table 1. Patients' general information

Group	Age (years)	Average age (years)	Stress urinary incontinence grading	Duration of disease (years)
Observation group (n = 40)	22–61	42.21 ± 8.33	20 mild cases 20 moderate cases	8.18 ± 2.44
Control group (n = 40)	21–60	42.37 ± 8.65	22 mild cases 18 moderate cases	7.92 ± 2.65
<i>t</i>		0.084	0.433	0.456
<i>P</i>	> 0.05	> 0.05	> 0.05	> 0.05

2.2. Methods

For the control group, a single pelvic floor muscle electrical stimulation treatment was administered. The selection of a suitable electrical stimulation frequency (generally 50–80 Hz) and pulse width (250–320 μs) depended on the patient's condition. The current was adjusted to the lowest level, ensuring strong muscle contraction without pain. Treatment duration was 30 minutes daily, twice a week, and a total of 10 sessions.

Patients in the observation group underwent pelvic floor muscle electrical stimulation combined with biofeedback. After completing the pelvic floor muscle electrical stimulation treatment, biofeedback therapy was introduced using high-frequency and low-frequency alternating treatment methods. This guided patients

through pelvic floor muscle exercises in a step-by-step manner, progressing from the first to the second type of fiber exercise and concluding with simultaneous exercise. Treatment duration and frequency were consistent with the control group.

2.3. Observation scope

- (1) Analysis of patient treatment effects: Categorized as markedly effective (all clinical symptoms of urinary incontinence disappear after treatment, and there is no more urine leakage in daily life), effective (clinical symptoms of urinary incontinence are significantly improved after treatment, and urine leakage is no longer present in daily life, or the number of urine leakage is reduced by more than half), or ineffective (the patient's clinical symptoms are not significantly improved or even worsened after treatment) ^[4].
- (2) Analysis of patient's pelvic floor muscle strength: Assessed before and after treatment.
- (3) Analysis of patient's quality of life: Utilized the Incontinence Quality of Life Questionnaire (I-QOL) with 22 questions, scoring from 0 to 100. A higher score indicates a lower level of urinary incontinence and a higher quality of life ^[5].
- (4) Analysis of adverse reactions.

2.4. Statistical processing

Data were entered into SPSS20.0 software, with statistical significance determined at $P < 0.05$.

3. Results

3.1. Comparison of patient treatment effects

Table 2 shows the total effective rate of patients treated with combination therapy was significantly higher than single pelvic floor muscle electrical stimulation treatment alone ($P < 0.05$).

Table 2. Analysis of patient treatment effects

Group	Markedly effective	Effective	Ineffective	Total effective rate
Observation group ($n = 40$)	18 (45.00)	20 (50.00)	2 (5.00)	38 (95.00 %)
Control group ($n = 40$)	15 (37.50)	17 (42.50)	8 (20.00)	32 (80.00 %)
χ^2				4.114
P				< 0.05

3.2. Pelvic floor muscle strength

As shown in **Table 3**, there was no statistical difference in the pelvic floor muscle strength between the two groups before treatment, but the observation group had a substantial improvement after treatment as compared to the control group ($P < 0.05$).

Table 3. Pelvic floor muscle strength before and after treatment

Group	Before treatment (μV)	After treatment (μV)
Observation group ($n = 40$)	12.21 \pm 1.54	25.86 \pm 1.71
Control group ($n = 40$)	12.44 \pm 1.63	21.25 \pm 1.62
t	0.649	12.378
P	> 0.05	< 0.05

3.3. Analysis of patients' quality of life before and after treatment

As shown in **Table 4**, there was no statistical difference in the quality of life score between the two groups before treatment, but the quality of life score of the observation group improved significantly after treatment as compared to the control group ($P < 0.05$).

Table 4. Analysis of patient quality of life before and after treatment

Group	Before treatment	After treatment
Observation group ($n = 40$)	42.11 ± 5.65	93.18 ± 4.54
Control group ($n = 40$)	42.72 ± 5.24	81.28 ± 4.72
<i>t</i>	0.501	11.492
<i>P</i>	> 0.05	< 0.05

3.4. Analysis of adverse reactions

Patients in both groups did not experience any adverse reactions during the treatment ($P > 0.05$).

4. Discussion

Stress urinary incontinence is a prevalent urinary system disease affecting a large number of women, significantly impacting their quality of life [6]. The primary characteristic of this condition is the occurrence of involuntary urine leakage during activities that increase intra-abdominal pressure, such as coughing, sneezing, running, lifting weights, etc. This imposes a substantial burden on patients' daily lives and self-esteem [7]. Addressing stress urinary incontinence in women is a crucial medical task, and various treatment options exist in clinical practice, including drug therapy, physical therapy, and surgical intervention, among others. However, pelvic floor muscle electrical stimulation combined with biofeedback stands out as a non-invasive treatment option that garnered clinical attention [8].

This combined treatment aims to enhance pelvic floor muscle function, improve urinary control, and alleviate symptoms, constituting a multi-faceted approach [9]. The mechanism involves regulating pelvic floor muscles, functional improvement, modulation of the nervous system, biofeedback, and motor learning. The electrical stimulation method stimulates pelvic floor muscles, promoting their contraction and relaxation, enhancing strength and endurance [10], and simulating nerve impulses to trigger muscle stimulation, ultimately increasing pelvic floor muscle tension and mobility [11].

Beyond its direct impact on muscles, electrical stimulation also influences the nervous system, optimizing neuromuscular coordination and reducing the occurrence of urine leakage incidents. Biofeedback technology, an integral part of this method, continuously monitors physiological parameters such as electromyography, urine flow, and pelvic floor muscle tension [12], providing real-time information on the relationship between pelvic floor muscle activity and urine leakage. This visual feedback aids patients in actively controlling muscles, improving pelvic floor muscle function, and urinary control through repeated exercises and training [13].

Several studies reported a significant reduction or complete disappearance of urinary leakage symptoms in female patients undergoing pelvic floor muscle electrical stimulation combined with biofeedback treatment. These effects are often long-lasting, lasting for months or even years [14]. The method is deemed relatively safe, with mild skin irritation as the primary side effect, easily manageable, and disappearing after treatment cessation [15].

In this study's results, the total effective rate of patients undergoing combined treatment was significantly higher compared to the control group ($P < 0.05$). Pelvic floor muscle data for the observation group were significantly higher post-treatment compared to the control group ($P < 0.05$). Quality of life scores for the observation group also showed a substantial increase post-treatment compared to the control group ($P < 0.05$). Importantly, no adverse reactions were reported in either group during treatment, affirming the safety and effectiveness of biofeedback combined with electrical stimulation in improving clinical symptoms and enhancing quality of life.

In conclusion, this study demonstrates that pelvic floor muscle electrical stimulation combined with biofeedback effectively addresses stress urinary incontinence in women through various pathways. This multi-modal treatment method empowers patients to regain urinary control, improving their quality of life and safeguarding the health of female patients at different levels.

Disclosure statement

The author declares no conflict of interest.

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