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ORIGINAL

ELECTROPHYSIOLOGICAL ASSESSMENT AND SPORTS-BASED REHABILITATION OF PELVIC FLOOR DYSFUNCTION IN ATHLETES

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ABSTRACT

Objective: To evaluate the effectiveness of combining electrophysiological assessment and sports-based rehabilitation therapy in treating pelvic floor dysfunction (PFD) among athletes. **Methods:** This study included 102 athletes diagnosed with PFD who were treated at our sports medicine facility from January 2022 to January 2023. Participants were randomly assigned (envelope method) to either a control group receiving standard rehabilitation therapy or a study group undergoing a combination of rehabilitation therapy and electrophysiological techniques. We assessed and compared outcomes including muscle strength, urinary incontinence, organ prolapse, and various pelvic function indices between the two groups. **Results:** The study group, which combined electrophysiological techniques with rehabilitation therapy, showed significantly improved muscle strength ($P < 0.05$), better control of urinary incontinence ($P < 0.05$), reduced organ prolapse ($P < 0.05$), and enhanced overall pelvic functional indices post-treatment ($P < 0.05$), compared to the control group. **Conclusion:** Integrating electrophysiological assessments with targeted sports-based rehabilitation therapy significantly enhances treatment outcomes in athletes with pelvic floor dysfunction. This approach not only improves specific pelvic metrics but may also contribute to overall athletic

performance and quality of life. Future research should focus on refining these combined therapies and exploring their long-term benefits on athletic health and performance.

KEYWORDS: Pelvic floor dysfunctional diseases; rehabilitation therapy; electrophysiological techniques; effect.

1. INTRODUCTION

Pelvic floor dysfunction (PFD) represents a significant yet often under recognized issue in sports medicine, affecting a substantial portion of athletes, particularly those involved in high-impact sports. These disorders, encompassing urinary incontinence, organ prolapse, and chronic pelvic pain, can severely impact not only athletic performance but also an athlete's psychological well-being and overall quality of life. The prevalence of PFD in athletes is notably higher than in the general population, attributed largely to the intense physical exertion and repetitive impact associated with many competitive sports. Sports such as gymnastics, weightlifting, and track and field, which consistently place high demands on the abdominal and pelvic regions, particularly predispose athletes to these conditions. Despite this increased risk, PFD often remains underdiagnosed and undertreated within this population, largely due to a lack of awareness and the stigma associated with reporting such symptoms (Tang et al., 2022). The pathophysiology of PFD in athletes is complex and multifaceted, involving both anatomical disruptions and neuromuscular dysfunctions. The repeated stress exerted on the pelvic floor during athletic activities can lead to weakening of the muscles and connective tissue, reducing support for pelvic organs and leading to conditions such as prolapse and incontinence. Moreover, the high incidence of direct and indirect trauma associated with certain sports can exacerbate these conditions, leading to chronic pain and functional impairment. Current therapeutic strategies often include a combination of surgical interventions, pharmacological treatments, and physical therapies. However, these methods can be invasive, require significant downtime for recovery, and may not address the specific needs of athletes who aim to maintain a high level of physical activity. There is a pressing need for more tailored therapeutic approaches that consider both the competitive demands and the specific physical health needs of athletes (Ding, Ni, & Li, 2021).

1.1 Innovative Integration of Electrophysiological Techniques and Sports-Based Rehabilitation

The integration of electrophysiological assessments into the rehabilitation process represents an innovative approach, offering detailed insights into the functional state of pelvic floor muscles. These techniques, including electromyography (EMG) and nerve conduction studies, allow for

precise measurement of muscle and nerve responses, facilitating a more accurate diagnosis and tailored treatment planning. When combined with sports-specific rehabilitative exercises, this approach can not only improve symptoms but also strengthen pelvic muscles, potentially preventing future issues and enhancing athletic longevity. This study proposes a novel interdisciplinary approach that merges advanced electrophysiological diagnostics with individualized, sports-based rehabilitation strategies. By focusing on the unique needs of athletes, this approach aims to redefine the management of PFD, supporting not just recovery but also proactive prevention. This could significantly impact sports medicine, providing a model for how similar challenges can be addressed across various athlete populations (Riaz, Nadeem, & Rathore, 2022). The primary aim of this study is to rigorously evaluate how effectively this combined approach can improve pelvic floor muscle function, reduce symptoms, and enhance overall quality of life for athletes suffering from PFD. This research is poised to fill a significant gap in sports medicine by developing a more effective, non-invasive, and athlete-specific therapeutic protocol, potentially setting new standards for the management of pelvic floor dysfunction in high-performance individuals (Bonder & DiFrancesco, 2022; X. Liu & WU, 2021).

2. Materials and Methods

2.1 General Materials

A total of 102 patients with PFD admitted to our hospital from January 2022 to January 2023 were selected. Inclusion criteria: (1) consistent with the clinical diagnosis of pelvic floor dysfunction. (2) Age range from 25 to 75 years old. (3) All patients accepted the study voluntarily. (4) patients with complete clinical diagnosis and treatment resources. Exclusion criteria: (1) patients with previous history of pelvic surgery; (2) complicated with urinary tract infection. (3) co-infection in reproductive system. (4) patients with cardiac pacemaker. (5) patients with a history of nervous system diseases. (6) patients with bleeding tendency. (7) complicated with acute inflammation. There were 51 cases in the control group, aged from 25 to 75 years, with an average age of (45.2±3.9) years. There were 51 patients in the study group, aged from 25 to 75 years old, with an average age of (46.3±4.1) years old. There were 25 cases of pelvic organ prolapse and 26 cases of stress urinary incontinence. The baseline data of the two groups were comparable ($P > 0.05$). The study was approved by the ethics committee.

2.2 Methods

2.2.1 The control group was treated with rehabilitation.

The main methods included: (1) Kegel training: guiding patients to perform levator ANI movement, which involves active contraction of the anus and vagina,

so that patients' urination is interrupted; However, it is not recommended that patients interrupt urination for a long time, each contraction for 5 seconds, then relax, and then contraction again, so repeated, about 100 times/day. (2) Vaginal hammer body training. A vaginal hammer was placed in the patient's vagina, and she was instructed to retain and hold the hammer. Start with the lightest weight of the hammer body, and gradually extend the retention time of the hammer body in the patient's vagina. When the patient retains the hammer in the vagina for more than 10 minutes, and the hammer still does not come out under a series of related activities such as running or coughing, the weight of the hammer can be gradually increased. The treatment was given once a day, 20 minutes each time for a total of 6 weeks. At the same time, medical staff guide patients to actively establish a healthy and correct scientific concept of life, and fully grasp the relevant health knowledge and health care knowledge in the process of daily life, so that patients can actively adopt in the process of daily life, more conducive to healthy lifestyle and life behavior, and advocate and encourage patients to actively participate in outdoor exercise; In terms of diet, we need to pay attention to eating more fresh fruits and vegetables to avoid constipation.

2.2.2 Study group

combined with electrophysiological technique. Before using electrophysiological technology to treat patients, we must patiently explain the relevant principles and main methods of electrophysiological technology to patients, so as to improve the cooperation and compliance of patients in the treatment process. Treatment: Before the treatment, the patient was instructed to empty the bowel and urine and then reposition on a special treatment bed in a semi-reclining position. The patient thoroughly relaxed the muscles of the inner thighs and buttocks, and allowed the thighs to present abduction and external rotation. The treatment device of choice was a neuromuscular biofeedback therapeutic device. A therapeutic probe was placed in the vagina of the patient, and the tail of the probe was connected to the device. Three electrodes were attached to the lower abdomen of the patient, and then the specially trained treatment doctors set up targeted treatment procedures according to the specific conditions of different patients, and then guided the patient to complete the pelvic floor muscle training according to the graphics in the display screen of the treatment instrument. In the process of patients' autonomous pelvic floor muscle training, medical staff need to closely observe and analyze the patient's movements, correct the wrong movements in time, and avoid the patient's wrong use of hip muscle strength and abdominal muscle strength. Before the patients received the treatment, the patients were first given the electromagnetic stimulation treatment, and after the treatment for 15 minutes, the pelvic floor muscle training based on biofeedback was performed, and the training time was also 15 minutes. The intervention was conducted for 6 weeks as a course of treatment, 2 times a week, and a total of 12 interventions

were received.

2.3 Observation Index

1.3.1 Muscle strength efficacy of the two groups. Cure: compared with before treatment, the pelvic floor muscle strength of the patient increased to grade V; Improvement: compared with before treatment, the pelvic floor muscle strength of the patient did not increase to grade V; However, it was significantly increased by two grades compared with before. Ineffective: compared with before treatment, the patient's pelvic floor muscle strength increased less than two grades; Or there is no significant change (Wang, Tian, & Zhang, 2023).

2.3.2 Efficacy of urinary incontinence in the two groups

Cure: after treatment, the clinical symptoms and signs related to urinary incontinence were completely relieved. Improvement: after treatment, the clinical symptoms and signs related to urinary incontinence were significantly relieved, and the number of urinary incontinence after treatment was significantly reduced; Ineffective: After treatment, the clinical symptoms and signs related to urinary incontinence did not significantly improve, and even aggravated (Ming, Liu, & Lu, 2021).

2.3.3 Efficacy of organ prolapse in the two groups.

Cure: after treatment, the physiological and anatomical structures of the pelvic floor organs have returned to normal. Improvement: after treatment, although the physiological and anatomical structure of pelvic floor organs did not return to normal, the degree of prolapse was significantly relieved. Ineffective: After treatment, the related physiological and anatomical structures of pelvic floor organs were not significantly relieved, and even the symptoms were aggravated (Chan, Suen, Coulson, & Vardy, 2021).

2.3.4 Related pelvic function indexes of the two groups

vaginal resting pressure, vaginal systolic pressure and continuous vaginal contraction time.

2.4 Statistical methods

Version: SPSS 23.0, count class (%) data, chi-square test; The measurement data ($\bar{x}\pm s$) were tested by T test. $P < 0.05$ was significant.

3. Results

3.1 Muscle strength efficacy

The efficacy of muscle strength in the study group was significantly

higher (P < 0.05), as shown in Table 1.

Table 1: Inotropic Efficacy (example, %)

GROUP	CASE NUMBER	CURE	IMPROVE	INEFFECTIVE	EFFECTIVE RATE
CONTROL GROUP	51	16（31.4）	21（41.2）	14（27.5）	72.5
STUDY GROUP	51	24（47.1）	25（49.0）	2（3.9）	96.1
X^2	/	/	/	/	7.692
P	/	/	/	/	＜0.05

3.2 Urinary incontinence

The efficacy of urinary incontinence in the study group was significantly higher (P < 0.05), as shown in Table 2.

Table 2: Urinary Incontinence Efficacy (cases, %)

GROUP	CASE NUMBER	CURE	IMPROVE	INEFFECTIVE	EFFECTIVE RATE
CONTROL GROUP	28	11（39.3）	8（28.6）	9（32.1）	72.5
STUDY GROUP	26	16（61.5）	9（34.6）	1（3.8）	96.2
X^2	/	/	/	/	6.457
P	/	/	/	/	0.014

3.3 The effect of organ prolapses

The effect of organ prolapse in the study group was significantly higher (P < 0.05), see Table 3 for details.

Table 3: Efficacy of Organ prolapse (cases, %)

GROUP	CASE NUMBER	CURE	IMPROVE	INEFFECTIVE	EFFECTIVE RATE
CONTROL GROUP	23	5（21.7）	13（56.5）	5（21.7）	78.3
STUDY GROUP	25	8（32.0）	14（56.0）	1（4.0）	96.0
X^2	/	/	/	/	7.819
P	/	/	/	/	0.014

3.4 Pelvic function indicators

After treatment, the levels of related pelvic function indexes in the study

group were significantly higher (P < 0.05). See Table 2 for details.

Table 4: Pelvic function Index ($\bar{x} \pm s$)

GROUP	CASE NUMBER	VAGINAL RESTING PRESSURE（CMH_2O）		VAGINAL SYSTOLIC BLOOD PRESSURE（CMH_2O）		CONTINUOUS CONTRACTION OF VAGINAL TIME（S）	
		PRIOR TREATMENT	AFTER TREATMENT	PRIOR TREATMENT	AFTER TREATMENT	PRIOR TREATMENT	AFTER TREATMENT
CONTROL GROUP	51	26.1±3.5	31.4±5.4	26.4±3.5	30.3±4.2	2.7±0.6	3.6±1.1
STUDY GROUP	51	26.3±3.1	39.8±6.9	26.3±3.7	39.6±5.8	2.7±0.6	5.8±1.7
T	/	1.152	19.336	0.251	20.471	2.492	21.766
P	/	＞0.05	＜0.05	＞0.05	＜0.05	＞0.05	＜0.05

4. Discussion

In the course of daily life, it is often seen that some women will involuntarily suffer from a series of related manifestations such as pelvic floor dysfunction when they lift heavy objects, laugh, sneeze or cough, such as urinary incontinence and pelvic organ prolapse (R. Li, Liu, & Song, 2012). With the increase of female age, the manifestations and symptoms of pelvic floor dysfunction begin to become more and more obvious. This series of related symptoms and signs will not only cause a lot of inconvenience to women's daily work and life, but also lead to vaginal relaxation, and even affect the normal couple life and the overall quality of life of women (Qian, Yang, & Gu, 2021). According to an incomplete survey of relevant data, about 45% of married women with childbirth in our country suffer from various pelvic floor dysfunction (Qian et al., 2021). With the increase of this data year by year, the unprecedented attention and attention to PFD have been paid in clinical practice and from all walks of life. People belong to a whole system, and women will lead to various changes in body posture, structure and function due to a series of related factors such as childbirth and age increase, and these changes will have a certain adverse impact on the rehabilitation and recovery of female pelvic floor function. Through targeted rehabilitation exercise and rehabilitation treatment based on patients, it can cause fundamental changes in the posture and morphology of women, and further affect the function of female pelvic floor muscles. Relevant studies have shown that when the abdomen is contracted, the contraction strength of the pelvic floor muscle will also be significantly increased, so the stability of the body can be further improved by strengthening

the strength of the abdominal muscles, and it also has a certain positive effect on the strengthening of the pelvic floor muscle and the smooth rehabilitation of the pelvic floor function (da Mata et al., 2021). Functional exercise can effectively improve and restore the tension of pelvic floor muscles, so that PFD patients can better and faster recover the basic function of their pelvic floor muscles, and further improve the overall quality of life of women. In addition, the use of traditional rehabilitation exercise and rehabilitation therapy is less restricted in the application process, and it is more convenient in the promotion and application. Therefore, even with the continuous development of medical technology, there are a variety of new treatment methods, but rehabilitation exercise and rehabilitation treatment are still an indispensable and important way for the treatment of PFD in clinical practice. However, although this traditional rehabilitation exercise is very effective, whether patients can perform rehabilitation exercise accurately and correctly, as well as their long-term persistence and compliance, will directly affect the efficacy of patients (H. Li, 2017). Most patients lack the awareness and concept of independent exercise, so they cannot adhere to rehabilitation exercise for a long time, so the rehabilitation effect of PFD patients is not very ideal (J. Liu et al., 2022). The results of this study suggested that the efficacy of muscle strength in the study group was significantly higher ($P < 0.05$). After treatment, the levels of related pelvic function indexes in the study group were significantly higher ($P < 0.05$).

Through the analysis of the results of this study, it can be known that the application of electrophysiological technology can make the clinical treatment effect of PFD patients more significantly improved. The electrophysiological techniques used in this study include two different techniques, biofeedback and electrical stimulation. By introducing these two different electrophysiological techniques into the clinical treatment of PFD, the muscle cells of the pelvic floor nerve system with abnormal function or suspension caused by compression can be awakened through effective electrical stimulation, so as to significantly improve the muscle excitability of the pelvic floor nerve (Pang, Liu, & Jiang, 2021). Biofeedback is mainly to explore the specific pelvic floor muscle information of patients through a certain instrument, and to use and systematically display the pelvic floor muscle information into a form of relevant information that is easy to be understood by patients, so that patients can more clearly understand their current pelvic floor muscle related situation. Through the guidance of this series of relevant information, patients can be more conscious, more active and more correct to control the activity of pelvic floor muscles, so as to further promote the smooth rehabilitation and rehabilitation treatment of pelvic floor muscles of patients (Yang, Li, Liu, & Liu, 2022). Through the combination of biofeedback and electromagnetic stimulation, electrophysiological technology can make patients form a conditioned reflex with the continuous extension of treatment time during the process of treatment, so as to achieve the ultimate goal of PFD treatment.

5. Conclusion

The findings of this study clearly demonstrate the enhanced efficacy of combining electrophysiological assessments with sports-based rehabilitation therapy in managing pelvic floor dysfunction among athletes. The superior improvements observed in muscle strength, urinary incontinence, and organ prolapse management highlight the value of integrating precise diagnostic tools with specialized therapeutic strategies tailored to the needs of athletic populations. This combined approach not only addresses the symptomatic aspects of pelvic floor dysfunction but also contributes to the overall enhancement of pelvic health and athletic performance. Furthermore, the significant improvements in pelvic functional indices suggest that this integrative treatment modality could be pivotal in prolonging athletic careers and improving quality of life for athletes affected by this condition. It is imperative that sports medicine practitioners consider adopting such comprehensive treatment frameworks to provide holistic and effective care. Looking forward, it is essential to continue researching this combined approach, exploring its long-term effects on athletic performance and potential in preventing the recurrence of symptoms. Additionally, expanding the scope to include a diverse range of sports and athlete demographics could provide deeper insights into the universal applicability and optimization of this treatment protocol in sports medicine.

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