Int J Clin Exp Med 2020;13(6):4571-4579
www.ijcem.com /ISSN:1940-5901/IJCEM0110001

Original Article

The feasibility of nursing intervention in postpartum pelvic floor muscle rehabilitation among puerperae and its influence on SUI incidence and comprehensive muscle strength

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Received February 28, 2020; Accepted April 9, 2020; Epub June 15, 2020; Published June 30, 2020

Abstract: Objective: To study the feasibility of postpartum pelvic floor muscle (PFM) rehabilitation in puerperae and analyze the influence of intervention on the incidence of postpartum stress urinary incontinence (SUI) and comprehensive muscle strength. Methods: 97 puerperae with singleton pregnancy through vaginal delivery (VD) in our hospital in 2019 were randomly divided into a study group (SG, n=49) and a control group (CG, n=48). The CG received routine postpartum rehabilitation nursing and the SG received postpartum PFM rehabilitation intervention in order to compare the improvement of pelvic floor muscle strength (PFMS) and electromyogram (EMG) values, the SUI incidence after the intervention for 1, 3, and 6 months, and the International Consultation on Incontinence Questionnaire Short Form (ICIQ-SF) and the Incontinence Quality of Life Questionnaire (I-QOL) scores before the intervention and at 6 months after the intervention. The incidence of pelvic floor dysfunction (PFD) was calculated at 6 months after surgery in the two groups. Results: The response rate of the SG was 97.96% (48/49), higher than the 87.50% (42/48) of the CG (P<0.05). There was no statistical difference in the pelvic floor EMG values in the two groups before the intervention or at 1 month after the intervention (P>0.05). The EMG value of the SG was much higher than it was in the CG at 3 and 6 months after the intervention (P<0.05). The SUI incidence in the SG was lower than it was in the CG during the intervention (P<0.05). The ICIQ-SF scores of the SG were lower and the I-QOL scores of the SG were higher than those of the CG after the 6 months intervention (P<0.05). The PFD incidence of the SG was lower than it was in the CG during the 6-month intervention (P<0.05). Conclusion: The postpartum PFM rehabilitation can significantly improve the PFMS of puerperae, reduce their incidence of postpartum SUI, and enhance their QOL, demonstrating a good intervention effect.

Keywords: Puerperae, pelvic floor muscle rehabilitation, nursing intervention, feasibility, SUI, comprehensive muscle strength, influence study

Introduction

With the overall opening of China's two-child policy in recent years, the birth rate of newborns and the incidences of obstetrical and gynecological diseases are increasing greatly, which arouses the attention of medical workers. Reconstructive pelvic surgery is an emerging sub-discipline of gynecology and obstetrics and aims to study the damage to pelvic floor tissues and pelvic floor dysfunction (PFD). And female pelvic floor dysfunctional disease is one of the research emphases in this discipline [1, 2]. The pelvic floor tissue of women is a complex structure composed of fascia and layers of muscles, including the inner, middle, and outer layers. This structure can close the pelvic outlet and support pelvic organs. Under normal conditions, pelvic floor muscles will cooperate with abdominal muscles to keep pelvic organs in their normal physiological positions. But pelvic floor muscles will be in a tension and high-load state due to pregnancy, which may induce muscle fatigue and even muscle atrophy. Further, pelvic floor muscles are pulled unduly due to the maternal delivery force and high intrauterine pressure during vaginal delivery (VD), which may lead to the extreme stretch and even fracture of muscle fibers and the structural defect of pelvic floor muscles and thus cause female pelvic floor dysfunctional disease [3-5].

According to clinical studies, pelvic floor dysfunctional disease is one of the five chronic diseases seriously threatening female health, including pelvic organ prolapse (POP), stress urinary incontinence (SUI), and chronic pelvic pain (CPP), etc. Taking SUI as an example, a study of 19,024 Chinese women showed that the SUI incidence was as high as 30.9%. Foreign studies also indicated that the SUI incidence of puerperae was 38% at 8 weeks after childbirth and 42% during pregnancy [6-8]. Based on the data stated above, a higher incidence of female pelvic floor dysfunctional disease can have a serious impact on women's physiological and psychological states. So the intervention should be implemented as early as possible.

Now, the means of intervention in female PFD include surgical treatment and non-surgical treatment. The former achieves intervention mainly by changing the patients' anatomical structure or implanting meshes, with the drawbacks of a high recurrence rate, a high cost, and a high susceptibility to infection, etc. The latter mainly achieves the intervention through medication, physical rehabilitation, electrical stimulation, and biological feedback, etc., so it is more acceptable to patients [9-11]. Pelvic floor muscle (PFM) rehabilitation therapy is an intervention used to recover the pelvic floor function and strengthen the contractility of connective tissues in the pelvic floor through electrophysiological stimulation and active or passive training to individual PFM so as to prevent and treat pelvic floor dysfunctional disease. Currently, PFM rehabilitation has been applied in clinical practice in many countries, and it shows a good effect at reducing the incidence of pelvic floor dysfunctional disease among puerperae [12-14]. This study aimed to analyze the effect of nursing intervention in pelvic floor rehabilitation with respect to reducing the SUI incidence and improving comprehensive muscle strength so as to provide theoretical guidance for postpartum rehabilitation. The details are shown below.

Materials and methods

General materials

97 puerperae with singleton pregnancies through VD in our hospital in 2019 were selected as the study cohort and randomly divided into the study group (SG, n=49) and the control group (CG, n=48).

Inclusion criteria: This study included (1) puerperae aged 20-35 years old; (2) primiparae with singleton pregnancies; and (3) puerperae who could finish the investigation with a clear consciousness and self-care ability; (4) this study was reported to and approved by the Ethics Committee of the Provincial Clinical Medical College of Fujian Medical University (Fujian Provincial Hospital); (5) the study participants or their family members signed an Informed Consent Form.

Exclusion criteria: This study excluded (1) puerperae with mental diseases; (2) those with a history of PFD; (3) those malignant tumors; (4) those with urinary tract infections; (5) those with a history of pelvic surgery; (6) those with impaired cognition; and (7) those with vesical fistula or other diseases that could affect the results.

Removal criteria: This study removed (1) puerperae who could not complete the investigation due to poor treatment compliance; and (2) those who applied for withdrawal during the investigation.

Intervention methods

The CG only received routine postpartum rehabilitation nursing. The medical workers explained the significance and necessity of postpartum pelvic floor rehabilitation to the puerperae and provided them with health education materials, excluding one-to-one guidance on rehabilitation training. Meanwhile, the puerperae were advised to return to the clinic at 1, 3, and 6 months after childbirth and to receive telephone follow-up.

The SG received one-on-one nursing intervention in postpartum PFM rehabilitation and health education, with the contents mainly including the steps, methods, principles, and cautions of PFM rehabilitation training. At the same time, the nursing intervention in PFM rehabilitation was implemented, with the specific measures shown below. (1) Kegel training. The puerperae of the SG were kept in a horizontal position with their legs bent and separated. Then they contracted the anus for about 6-8 s while breathing in and relaxed the anus while breath-

ing out. This exercise was repeated for 30 min each time, 3 times a day. The treatment course was 6-8 weeks. Attention was paid to avoiding the participation of the leg and gluteal muscles. After mastering the basics of the exercise, the puerperae could do the exercises in a sitting or standing position, gradually prolonging the contracting and exercise times. During the exercise, intermittent urination training was added, namely stopping or slowing down the urine stream while urinating. (2) Biological feedback and electrical stimulation of PFM. The electrodes of PFM rehabilitation instrument were put into the vagina for high-frequency electrical stimulation under high current intensity (the current intensity shall not exceed 100 mA). The stimulation lasted for 2 s each time and the interval time was 4 s. This therapy was performed for 30 min each time, twice a week. The treatment course was 6 months. (3) Vaginal cone training. Cones weighing 20 g, 32 g, 45 g, 57 g, and 69 g were inserted into the vagina to the depth of a finger after it was covered with lubricating fluid. The puerperae were advised to tighten their muscles and then stand up for the exercise after feeling the rising of the cone inside the vagina. The weight of the cone was selected from the light to the heavy. This exercise lasted for 20 min each time, once a day. After the puerperae tolerated a heavier cone, the exercise could be combined with cough and jump, etc.

Observation targets and evaluation standards

Response rate (RR): The pelvic floor muscle strength (PFMS) was measured manually to evaluate the therapeutic effect at 6 months after the intervention, with the specific evaluation methods shown below. After the patients separated their knees in a fowler position, the examiner gently pressed the abdomen of the subjects with his/her left hand and inserted his/her right middle finger and index finger into the vagina of subjects. Then, the subjects contracted their vaginas according to the examiner's command. Grade 0 meant that the examiner could not feel muscle contraction; Grade 1 meant that the examiner could feel the muscle wriggling or the contraction slightly, but the subjects could not maintain the muscle wriggling or the contraction; Grade 2 meant that the examiner could feel muscle contraction for 2 s and the subjects could do it twice; Grade 3 meant that the subjects could maintain muscle contraction for 3 s and do it 3 times; Grade 4 meant that the subjects could maintain muscle contraction for 4 s and do it 4 times; and Grade 5 meant that the subjects could maintain muscle contraction for 5 s and do it 5 or more times [15]. The muscle strength was compared before intervention and at 6 months after the intervention. The enhancement of 2 grades referred to marked effectiveness; that of 1 grade referred to effectiveness; and no enhancement referred to ineffectiveness. RR = (number of markedly effective cases + number of effective cases)/ total number of cases ×100%.

Changes in the electromyogram (EMG) values before and after the intervention

A PHENIX instrument was used to evaluate the EMG values of two groups respectively before the intervention and at 2, 3, and 6 months after the intervention. Each index was determined 3 times, and the mean value was the final result. The results were compared before and after the intervention within each group and between the groups.

The SUI incidence of two groups during the intervention

The follow-up visit or a subsequent visit was used to record the SUI incidence of two groups at 1, 3, and 6 months after the intervention. The comparison were conducted between the groups.

Changes in the International Consultation on Incontinence Questionnaire Short Form (ICIQ-SF) and the Incontinence Quality of Life Questionnaire (I-QOL) scores before the intervention and at 6 months after intervention

The urinary incontinence and QOL scores were measured before the intervention and at 6 months after the intervention. The ICIQ-SF included 4 items, i.e. the frequency of urine leakage (0-21 points), the volume of urine leakage (0-6 points), the frequency of urine leakage (0-5 points), and a self-diagnosis of the cause of urine leakage (unscored). The total scores were the sum of the points for each item. The higher the number of points, the more severe the urine leakage [16]. The I-QOL included 22 questions, and each question had 5 options, for a total possible score of 100. According to

Table 1. Comparison of the general clinical data between the two groups ($\bar{x} \pm s$)/[n (%)]

General clinical data		SG (n=49)	CG (n=48)	t/X^2	*P*
Average age (years)		28.01±2.23	27.99±2.41	0.042	0.967
Average gestational age (weeks)		39.12±1.23	39.14±1.31	0.078	0.938
Neonatal weight (kg)		3.51±0.43	3.50±0.44	0.113	0.91
Body mass index (BMI) (kg/m^2)		21.34±3.21	21.22±3.51	0.176	0.861
Educational level	Illiterate	5	6	0.332	0.722
	Primary school	10	8		
	Junior high school	23	22		
	Senior high school or above	11	12		
Marital status	Married	47	46	0.0	0.983
	Single	2	2		
Monthly income (yuan)	<5000	13	14	0.231	0.728
	5000-9999	29	28		
	>10000	7	6		

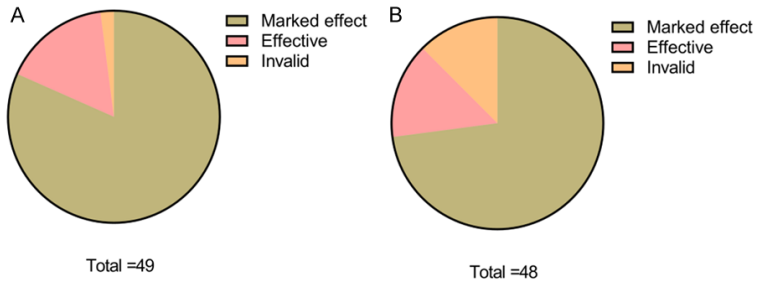

Figure 1. Comparison of the RR between the two groups at 6 months after the intervention. There were 40 markedly effective cases, 8 effective cases, and 1 ineffective case in the SG after the six-month intervention, with an RR of 97.96% (A). There were 35 markedly effective cases, 7 effective cases, and 6 ineffective cases in the CG after the six-month intervention, with an RR of 87.50% (B). There were significant and statistical differences in the RR between the two groups (P<0.05).

the scoring method of 1-5, the higher the scores, the better the QOL [17].

Comparison of the PFD incidence between two groups during the intervention

The telephone follow-up or subsequent visits were used to record the PFD incidences of the two groups during the 6-month intervention, including SUI, POP, vaginal wall protruding, and pelvic pain, etc. Then, comparisons were carried out between the groups.

Statistical methods

If the data about the two groups were correct, SPSS 20.0 was used to process and analyze these data in terms of their statistical significance. The measurement data were represented as the mean ± standard deviation and compared between the groups using Student's t tests. The enumeration data were represented by [n (%)] and compared between the groups using chi-square tests. P<0.05 meant that the difference had statistical significance [18].

Results

Comparison of the general clinical data between the two groups

According to the general clinical data, there was no statistical difference, but there was comparability in terms of the average age, average gestational age, and marital status, etc. between the two groups (P>0.05) (**Table 1**).

RR

According to our evaluation, there were 40 markedly effective cases, 8 effective cases and 1 ineffective case in the SG after the six-month intervention, with an RR of 97.96%, and there were 35 markedly effective cases, 7 effective cases, and 6 ineffective cases in the CG after the six-month intervention, with an RR of 87.50%. There was a significant difference in the RR between the two groups (P<0.05) (**Figure 1**).

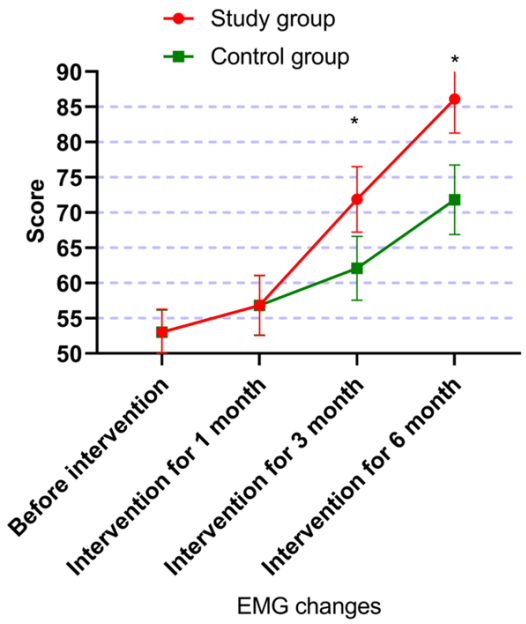

Figure 2. Changes in the EMG values before and after the intervention. There was no significant differences in the pelvic floor EMG values between the two groups before the intervention and at 1 month after the intervention (P>0.05). The EMG value of the SG was much higher than it was in the CG at 3 and 6 months after the intervention, showing significant and statistical differences (P<0.05). * means the statistical difference in the same index between the groups.

Changes in the EMG values before and after the intervention

The measurements indicated that the EMG values in the two groups were similar before the intervention and at 1 month after the intervention, showing no statistical differences (P> 0.05). The EMG values of the two groups increased significantly at 3 and 6 months after the intervention, showing a significant statistical difference (P<0.05). In addition, the EMG values in the SG were higher than they were in the CG at 3 and 6 months after the intervention (P<0.05) (**Figure 2**).

SUI incidence of the two groups during the intervention

According to follow-up records, the SUI incidence in the SG was much lower than it was in the CG during the follow-up visits, showing a significant and statistical difference between the two groups (P<0.05) (**Figure 3**).

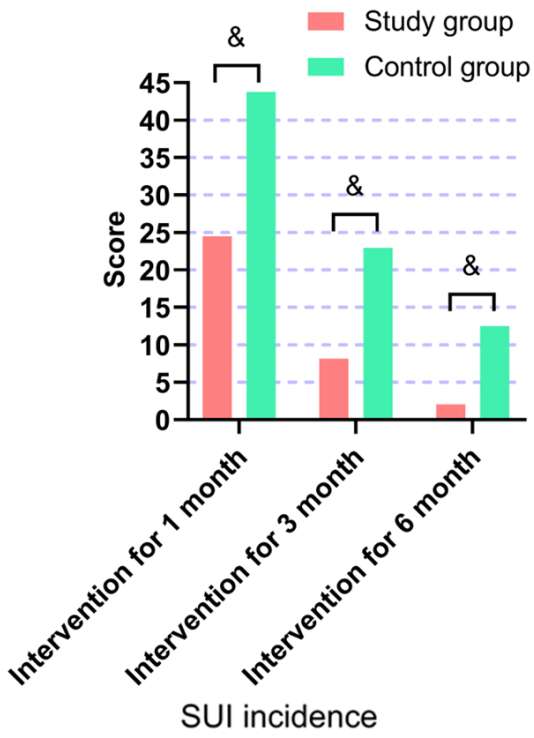

Figure 3. The SUI incidences in the two groups during the intervention. The SUI incidences in the SG and CG were respectively 24.49% and 43.75% at 1 month after the intervention; 8.16% and 22.92% at 3 months after the intervention; and 2.04% and 12.50% at 6 months after the intervention. & means a statistical difference in the same index between the groups.

Changes in the ICIQ-SF and I-QOL scores before the intervention and at 6 months after the intervention

According to our evaluation, the ICIQ-SF and I-QOL scores of two groups were similar before the intervention, showing little statistical difference (P>0.05). The ICIQ-SF scores decreased and the I-QOL scores increased in the two groups at 6 months after the intervention, showing statistical differences before and after the intervention (P<0.05). Also, the ICIQ-SF scores in the SG were lower than they were in the CG, and the I-QOL scores in the SG were higher than they were in the CG (P<0.05) (**Table 2**).

Comparison of the PFD incidence between the two groups during the intervention

According to the follow-up records, there were 12 puerperae with SUI, 1 puerpera with POP or

Table 2. Changes in the ICIQ-SF and I-QOL scores before the intervention and at 6 months after the intervention ($\bar{x} \pm s$)

Group	Number of cases	ICIQ-SF		I-QOL	
		Before intervention	6 months after intervention	Before intervention	6 months after intervention
SG	49	12.67±2.01	3.87±0.32*	35.38±3.23	70.28±3.44*
CG	48	12.71±1.87	6.91±0.29*	35.61±3.43	61.28±3.29*
t	-	0.101	48.996	0.34	13.164
P	-	0.92	<0.001	0.735	<0.001

Notes: *means P<0.05 compared with the value before the intervention.

Table 3. Comparison of the PFD incidence between the two groups during the intervention [n (%)]

Group	Number of cases	SUI	POP or vaginal wall protruding	Pelvic pain	Total incidence
SG	49	12 (24.49)	1 (2.04)	2 (4.08)	15 (30.61)
CG	48	21 (43.75)	2 (4.17)	3 (6.25)	26 (54.17)
X^2	-	-	-	-	5.513
P	-	-	-	-	0.019

vaginal wall protrusion, and 2 puerperae with pelvic pain in the SG, for a total incidence of 30.61%. There were 21 puerperae with SUI, 2 with POP or vaginal wall protrusion, and 3 with pelvic pain in the CG, for a total incidence of 54.17%, showing a statistical difference (P< 0.05) (**Table 3**).

Discussion

As clinical studies show, the soft tissues of the pelvic floor are composed of three layers. The outer layer is superficial fascia and muscle layer. The middle layer is the urogenital diaphragm, mainly including fascia and muscle tissues. The inner layer is the most tenacious structure of the three layers, including the levator ani muscle and the fascia. PFM, in the shape of loophole, keeps the bladder, uterus, rectum, and other pelvic organs in their normal physiological positions, participates in the process of controlling urination and defecation, and also plays a role in maintaining vaginal contraction [19]. With the emergence of the aging population and the increase in the birth rate in recent years, the incidence of pelvic floor dysfunctional disease increases progressively year after year. Pelvic floor dysfunctional disease mainly refers to a series of diseases with clinical symptoms caused by pathological changes in the physiological states or functions of the pelvic organs or by positional changes of the pelvic organs due to tissue damage or weak support of the pelvic floor for different reasons. According to available data, the incidence of pelvic floor dysfunctional disease is about 20%-40%. SUI and POP are typical manifestations of this disease [20].

A scholar studied the correlation of pregnancy and childbirth with pelvic floor dysfunctional disease and indicated that pregnancy and childbirth are independent risk factors of this disease. As this scholar indicated, the reason is that the PFM of puerperae are in high-tension and high-load states due to pregnancy, and their pelvic floor muscles are pressured by the head of the fetus, which causes muscle fatigue and even muscle atrophy. In addition, the PFM is stretched unduly in a high-pressure state during childbirth, which leads to extreme stretching and even the fracturing of the muscle fibers, further causing irreversible damage to the pelvic floor muscle function [21]. A study on 1,749 primiparae conducted 12 months after childbirth showed that the incidence of postpartum SUI was 47.5%. Some other studies also showed that most puerperae adopting VD suffered from SUI or other types of urinary incontinence after childbirth. Meanwhile, there was vaginal relaxation, frequent micturition, constipation and other symptoms, which greatly affected their normal life [22].

At present, many clinical investigations show that the inner muscle of the PFM is a voluntary muscle with the possibility of manual intervention. So it is of positive significance to implement PFM rehabilitation training in the early stages so as to improve the pelvic floor function and reduce the incidence of all complications. The authors analyzed the feasibility of nursing intervention in postpartum PFM rehabilitation

among puerperae and its influence on the incidence of postpartum SUI and comprehensive muscle strength. The results showed that compared with the CG which received no pelvic floor rehabilitation, the SG that did receive rehabilitation nursing achieved an RR of 97.96% at 6 months after the intervention, which was much higher than the 87.50% of the CG. Further research indicated that the EMG value of the SG was higher than it was in the CG at 3 and 6 months after the intervention. This implied that PFM rehabilitation can enhance the efficacy of the intervention by regulating PFMS. Some studies showed that PFM rehabilitation can be achieved through surgical and non-surgical methods. Compared with the former, the latter was safer and more acceptable to the subjects. PFM rehabilitation can greatly improve the postpartum pelvic floor function of puerperae. For the 84% of the patients who received the intervention, the average number of enuresis nocturna was reduced from 2-3 to 0.18, and the average number of weekly urine leakage incidents was reduced from 5 to 1, showing a cure rate of 54% [23]. As some other studies have indicated, PFM exercises can enhance the RR of postpartum intervention in PFM from 74% to 96%, which is similar to the findings of this study [24]. As the author indicated, it is an indisputable fact that the pelvic floor function of puerperae is damaged after childbirth, but rehabilitation training can effectively improve the pelvic floor function through muscle exercise + electrical stimulation + endurance training. Accordingly, muscle exercise and endurance training can move the muscles around the pelvic floor and dilate the blood vessels of the PFM through continuous relaxation and contraction so as to improve vascular fluidity and microcirculation, enhance the metabolic rate of the muscle tissues and thus recover the nerve conduction and sensibility of the muscle tissues. And electrical stimulation can reduce the threshold value of the PFM tissues and effectively recover the conduction function of the nerve cells. Thus, the muscle tissues are contracted passively due to electrical stimulation, which will enhance the elasticity of the muscles. In addition, electrical stimulation can also inhibit the secretion of prostaglandin and reduce the permeability of the capillaries around the PFM tissues, aiming to improve the exudation and edema of the PFM and the inflammatory change caused by muscle injury and consequently change the pelvic floor function [25]. In this study, the postpartum SUI incidence of the SG was much lower than that of the CG, which supports the above argument. This implies that PFM rehabilitation is of positive significance in reducing the SUI incidence of puerperae. Also, the changes in the ICIQ-SF and I-QOL scores were also analyzed before and after the intervention in this study. The final results showed that PFM rehabilitation significantly reduced the incidence of postpartum urine leakage and improved the QOL of the puerperae, a finding that is similar to those of other studies.

Finally, we analyzed the influence of nursing intervention in PFM rehabilitation on the postpartum PFD of puerperae. As the results show, the SUI incidence in the SG was 24.49% after the intervention. The incidence of POP or vaginal wall protrusion was 2.04%, and the incidence of pelvic pain was 4.08%. The total incidence in the SG was 30.61%, much lower than the 54.17% in the CG. The reason may be that the long-term exercises for pelvic floor function can recover the normal function of the PFM to the utmost extent and thus recover the puerperae's ability to control urination and finally reduce the incidence of PFD.

In conclusion, postpartum PFM rehabilitation can significantly improve the PFMs of puerperae, reduce the incidence of postpartum SUI, and enhance their QOL, showing a good intervention effect. The weaknesses of this study are shown below. (1) The results were not comprehensive enough due to the small study cohort and the smaller sample size. (2) The objects were primiparae with singleton pregnancies, and grand multiparae were excluded, so the clinical applicability is inadequate. (3) The follow-up only lasted for 6 months, so the influence of the intervention on the puerperae's pelvic floor function could not be traced for a long time. In the future, the authors intend to conduct a study with a larger sample size and a longer follow-up period so as to provide a theoretical basis for the postpartum rehabilitation training of puerperae.

Acknowledgements

Startup Fund for Scientific Research, Fujian Medical University (Grant number 2017XQ11-48).

Disclosure of conflict of interest

None.

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