Effect of gestational weight gain as well as rehabilitation training on postnatal pelvic muscle strength

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Summary

Objective: The current study explored the impact of gestational weight gain on postnatal pelvic muscle strength and the effect of low-frequency electrical stimulation combined with biofeedback training on strength recovery. *Materials and Methods:* A total of 126 mothers six to eight weeks after term delivery were recruited at Peking University Shenzhen Hospital from August 2010 to July 2011. According to gestational weight gain, they were divided into two groups: the < 15 kg (A) and ≥ 15 kg (B) groups. Pelvic floor muscle fibre strength was determined. Target low-frequency electrical stimulation combined with biofeedback training was conducted. After training, pelvic floor muscle fiber strength was determined again for effect evaluation. *Results:* Before training, types I and II pelvic floor muscle fiber strength of group B was noticeably lower than that of group A ($p < 0.05$). After rehabilitation, the pelvic floor muscle strength of both groups significantly increased ($p < 0.05$). However, types I and II pelvic floor muscle fiber strength of group B was still significantly lower than that of group A ($p < 0.05$). *Conclusion:* Gestational weight gain negatively influences pelvic floor muscles. Low-frequency electrical stimulation combined with biofeedback training improves postnatal pelvic floor muscle fiber strength. A less gestational weight increase indicates faster postnatal pelvic muscle strength recovery and a better rehabilitative effect.

Key words: Gestational weight gain; Low-frequency electrical stimulation; Biofeedback; Pelvic floor muscle fiber strength.

Introduction

The pelvic floor is composed of multi-layer muscles and fascias close to the pelvic outlet and responsible for maintaining the functions of pelvic organs [1]. Abnormalities in pelvic floor muscles lead to pelvic floor dysfunction, which has become both a social and health problem worldwide. Urinary incontinence and pelvic organ prolapse are two major manifestations of pelvic floor dysfunction, and pregnancy and childbirth are widely-recognized independent risk factors causing such dysfunction. During pregnancy, because of fetal growth and gradual expansion of the uterus, long-term compression of the pelvic floor persists; consequently, such excessive dragging causes the elongation of the pelvic floor muscles and thereby leads to pelvic tissue relaxation and damage [2-8].

To explore the impact of gestational weight gain on pelvic floor muscles and the effect of low-frequency electrical stimulation, combined with biofeedback training on muscle strength recovery, 126 delivery women were recruited in this study.

Materials and Methods

Patients

A total of 126 women for doctors' office visit six to eight weeks after term delivery at Peking University Shenzhen Hospital from August 2010 to July 2011 were enrolled. Their ages ranged from 24 to 35 years with an average of 29.33 ± 2.77. Their gestational weight gains ranged from six to 30 kg. According to these gains, the patients were divided into two groups: group A (pregnant weight gain < 15 kg; n = 56) and group B (pregnant weight gain ≥ 15 kg; n = 70). The respective average weight gains of the two groups were 11.21 ± 2.34 kg and 19.01 ± 4.04 kg. The inclusion criteria included full-term delivery, free lochia, normal cognition, no serious medical and surgical disease, and no genitourinary infection.

This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Peking University Shenzhen Hospital. All patients signed a written informed consent and accepted low frequency electrical stimulation combined with biofeedback training voluntarily.

Methods

An electromyographic (EMG) probe was placed into the vagina with the other end connected to a PHENIX neuromuscular training apparatus.

Types I and II pelvic floor muscle fiber strength [9] Type I pelvic floor muscle fiber strength refers to the maximal strength when pelvic floor muscle contraction reaches 40% within ten seconds. It was determined based on time of duration of the contraction: zero, one, two, three, four, and five seconds were recorded as levels 0, 1, 2, 3, 4, and 5, respectively. Class II pelvic floor muscle fiber strength refers to the maximal strength when pelvic floor muscle contraction and relaxation reach 70%-90% within ten seconds. It was determined based on the numbers of muscle contraction and relaxation satisfying that criterion: zero, one, two, three, four, and five were respectively recorded as levels 1, 2, 3, 4, and 5.

Low-frequency electrical stimulation combined with biofeedback Low-frequency electrical stimulation parameters were individually designed according to determined pelvic floor muscle strength. Further, training was conducted according to effect combined with biofeedback. The training lasted 20-30 min, two times weekly and ten to 15 times in total.

Statistical analysis

Data were analyzed by SPSS 1.19 software. *T*-tests were performed to compare the effects of different pregnant weight gains

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on pelvic floor muscle strength, and paired-sample *t*-tests to evaluate the effect of training. A $p < 0.05$ was considered statistically significant.

Results

Weight effect

Before training, types I and II pelvic floor muscle fiber strength values of group A were 2.75 ± 1.68 and 2.18 ± 1.45, whereas those of group B were 1.57 ± 1.67 and 1.00 ± 1.32, showing significant differences ($p < 0.05$; Table 1).

Muscle fiber strength before and after training

The mean pre-training I and II pelvic floor muscle fiber strength values of both groups were 2.10 ± 1.77 and 1.52 ± 1.50. After training, the values significantly increased to 4.35 ± 1.08 and 3.70 ± 1.40 (both $p < 0.05$). The results are summarized in Table 2.

Muscle strength comparison after training

Types I and II pelvic floor muscle fiber strength values of group A were 4.68 ± 0.60 and 4.07 ± 0.97, respectively, whereas those of group B were 4.09 ± 1.28 and 3.40 ± 1.62, respectively. Significant differences were observed ($p < 0.05$; Table 3).

Table 1. — *Comparison of the two groups' maternal pelvic floor muscle strength before rehabilitation.*

Group	Number	PFMFS I (Mean ± SD)	PFMFS II (Mean ± SD)
A	56	2.75 ± 1.68	2.18 ± 1.45
B	70	1.57 ± 1.67	1.00 ± 1.32
t		3.926	4.763
p		< 0.001	< 0.001

PFMFS: pelvic floor muscle fibers strength.

Table 2. — *Comparison of maternal pelvic floor muscle strength before and after rehabilitation.*

Period	Number	PFMFS I (Mean ± SD)	PFMFS II (Mean ± SD)
Before training	126	2.10 ± 1.77	1.52 ± 1.50
After training	126	4.35 ± 1.08	3.70 ± 1.40
t		12.602	12.979
p		< 0.001	< 0.001

PFMFS: Pelvic floor muscle fibers strength.

Table 3. — *Comparison of the two groups' maternal pelvic floor muscle strength after rehabilitation.*

Group (kg)	Number	PFMFS I (Mean ± SD)	PFMFS II (Mean ± SD)
A	56	4.68 ± 0.60	4.07 ± 0.97
B	70	4.09 ± 1.28	3.40 ± 1.62
t		3.419	2.883
p		0.001	0.005

PFMFS: pelvic floor muscle fibers strength.

Discussion

Pelvic floor muscles support pelvic organs. Levator ani muscle, as a major component of the floor, plays a decisive role. During pregnancy, fetal growth and persisting compression weaken the contractility of pelvic floor muscles, especially levator ani muscle. In such a condition, if body weight increases too much and when levator ani musculotonic damage surpasses 30% of its maximal contractility, muscular ischemia and degeneration will occur; this change causes pelvic floor tissue relaxation and further leads to pelvic floor dysfunction syndrome [10-14].

Anatomically, with gradual pregnant uterine increases in both size and weight, the pelvis becomes more and more vertical. By the third trimester, it has almost become a vertical organ which directly compresses the pelvic floor [15-19]. To full-term gestation, the average increased weight of pregnant women reaches as high as 12.5 kg, which includes the weight of the fetus, placenta, amniotic fluid, uterus, breast, blood, interstitial fluid, and fat deposition; this increased weight directly or indirectly acts on the pelvic floor [20].

In this study, two groups were divided, taking the gestational weight gain of 15 kg as the dividing line (groups A and B). The average weight gain of group A was 11.21 ± 2.34 kg, whereas that of group B was 19.01 ± 4.04 kg. As shown in Table 1, types I and II pelvic floor muscle fiber strength of group B was significantly lower than that of group A ($p < 0.05$). This finding shows that a more gestational weight gain indicates more serious muscle damage to the pelvic floor.

Low-frequency electrical stimulation combined with biofeedback training can achieve a better recovery effect on pelvic floor muscles compared with other treatment procedures [21-24]. Therefore, this technique is feasible for postnatal immediate maternal pelvic floor rehabilitation. As shown in Table 2, after training, types I and II pelvic floor muscle fiber strength in all the participants significantly increased. In addition, Table 3 shows that the pelvic floor muscle fiber strength values of group B were significantly lower than those of group A even after training, which suggests that a less gestational weight gain indicates faster pelvic floor muscle strength recovery and a better training effect.

In summary, a more gestational weight gain results in a greater damage to pelvic floor muscles. This type of damage can be cured by effective low frequency electrical stimulation combined with biofeedback training. A less gestational weight gain suggests a more rapid pelvic floor muscle strength recovery, as well as a more effective training outcome.

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