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A NEW APPROACH TO POSTPARTUM REHABILITATION OF PATIENTS WITH PELVIC FLOOR DYSFUNCTION

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Aim *To determine the effectiveness of portable electrical stimulation of perineal muscles combined with the radiofrequency lifting of the vulvar tissues for prevention and non-invasive correction of pelvic floor dysfunction in late postpartum period.*

Material and methods *The study comprised 34 patients of the reproductive age presenting with initial manifestations of pelvic floor dysfunction and clinical forms of pelvic organs prolapse, not exceeding POP-Q stage 1. The study group included 18 women, of whom six patients had POP-Q stage 1 pelvic organ prolapse. Sixteen women, including five patients with POP-Q stage1pelvic organ prolapse made up a control group. The baseline clinical assessment included detailed medical history to identify risk factors for pelvic floor dysfunction before and after childbirth, a thorough analysis of complaints, physical examination, visual inspection of the perineum with functional tests and perineometry, bimanual vaginal examination, laboratory tests, transvaginal and transperineal ultrasound. The study participants completed the PFDI-20 (Pelvic Floor Distress Inventory), FSFI-19 (Female Sexual Function Index), PISQ-12 (Pelvic Organ Prolapse and Incontinence Sexual Function Questionnaire) questionnaires. During the late postpartum period, the patients of the study group received pelvic floor muscle stimulation using the SensaTONE portable electric stimulator (China) concurrently with radiofrequency lifting with the 4.0 MHz Surgitron DF S5 (USA) by Pelleve technology. Patients performed the procedures by themselves after the preliminary training.*

Results *Compared with the patients of the control group, in patients of the study group electrical muscle stimulation combined with radiofrequency lifting of the perineal region resulted in a significant decrease in symptoms of pelvic floor dysfunction ($p < 0.05$), as measured by questionnaires, perineometry and pelvic floor muscle contraction strength estimated by the Oxford grading system. Changes in transperineal ultrasound parameters observed three months after the initiation of the rehabilitation program did not differ statistically significantly between groups.*

Conclusion *Our findings suggest that treating vulvar and perineal tissue by radiofrequency energy using the 4.0 MHz Surgitron DF S5 by Pelleve technology concurrently with portable electrical stimulation of perineal muscles are quite effective as it is a combined technique, affecting several levels: the vulva, perineal tissues, and cross-striated muscles of the pelvic floor.*

Keywords: *pelvic floor dysfunction, vaginal relaxation syndrome, postpartum prolapse, electrical muscle stimulation, radiofrequency lifting*

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Pelvic floor dysfunction is defined as a complex of disorders of pelvic floor muscles and ligaments that hold the pelvic organs in a normal position and maintain their functions [1]. Pelvic floor dysfunction affects at least 31.4% of the population of women in the reproductive age [2]. Symptoms of the condition are not specific and may include lower abdominal pain, problems associated with voiding and bowel movements, sexual dysfunction, and recurrent microbiocenotic disorders [3-6].

Among early forms of prolapse, some researches differentiate the vaginal relaxation syndrome [7]. In the initial stages of the vaginal wall descent, vaginal introital laxity can cause sexual problems, which may lead to a lessening of sexual satisfaction. This condition results from weakening of the orgasmic cuff after childbirth, which leads to a significant reduction of the strength and quality of the contractions. Not restored perineal muscles torn during vaginal delivery and ligated vaginal venous plexuses disrupt vaginal blood flow during coitus, thus preventing the formation of an orgasmic cuff [8].

Pregnancy and delivery are the most prominent risk factors for the onset of pelvic floor dysfunction. Patients with pelvic floor dysfunction may have a history of completely normal childbirth or delivery of a large fetus, repeat childbirth, or injury to the pelvic floor from childbirth. The vast majority of patients with pelvic organs prolapse (91–99.5%) vaginal delivery, often more than one, most of which (56.4–72%) were complicated by perineal injury [9].

According to the integral theory of pelvic floor dysfunction, pelvic organ prolapse and symptoms of chronic pelvic pain and bladder and bowel dysfunction are mainly caused by laxity in five main suspensory ligaments that retain pelvic organs in the physiological position: pubourethral ligament, arcus tendineus fascia pelvis, cardinal ligament, uterosacral ligament, and

perineal body [10]. During pregnancy, a significant enlargement of the uterus and an increase in intra-abdominal pressure result in stretching of these ligaments causing a counteraction from the pelvic floor muscles. During childbirth, the fetal head exerts pressure on the pelvic floor muscles and birth canals of the parturient woman, which can lead to their damage and the formation of pelvic fascia defects. This mechanism explains the occurrence of pelvic floor dysfunction in women in the postpartum period. Thus, the first 6-8 weeks after childbirth is the most vulnerable period in a woman's life, when the fascia membranes and other connective structures are undergoing physiological changes, and striated pelvic floor muscles are unable to provide full pelvic floor support to the pelvic viscera.

There is a wide range of modalities for postpartum pelvic-floor rehabilitation [11–13]. In recent years, there has been an increasing amount of literature on the role of aesthetic gynecology, in particular, the radiofrequency in postpartum perineal and vulvovaginal tissue restoration [14, 15]. The recent international literature demonstrates a trend towards solving the problems of urinary/fecal incontinence and sexual dysfunction [16–18]. However, pelvic floor dysfunction develops as a result of a multilevel injury: vulvar and perineal ruptures, damage to the neurovascular bundles and ligaments; possible injury to adjacent organs (bladder, rectum), overstretch of the tissues of the birth canal. From these positions, in our opinion, it is justified to use a combined rehabilitation program for this category of patients, which includes a direct external stimulation of the vulvar and perineal area to speed up the reparative processes, to exert lifting effect, eliminate the symptoms of sexual dysfunction, and strengthen the pelvic floor muscles.

This study aimed to determine the effectiveness of portable electrical stimulation of perineal muscles combined with the radiofrequency lifting of the vulvar tissues for prevention and non-invasive correction of pelvic floor dysfunction in the late postpartum period.

Material and methods

The study comprised 34 patients of the reproductive age presenting with initial symptomatic manifestations of pelvic floor dysfunction and clinical forms of pelvic organ prolapse. The study was conducted at the Department of Gynecology of the F.I. Inozemtsev City Clinical Hospital. The age of the patients ranged from 25 to 33 years. The study group included 18 women, of whom six patients had POP-Q stage 1 pelvic organ prolapse. Sixteen women, including five patients with POP-Q stage1pelvic organ prolapse, made up a control group. The inclusion criteria were: patient consent to participate in the study and manifestations of pelvic floor dysfunction in the late postpartum period. Exclusion criteria: pregnancy, POP-Q stage 2 and more pelvic organ prolapse; severe extragenital comorbidities, congenital genitourinary anomalies, clinically significant gynecological diseases (uterine myoma, endometriosis, benign pelvic tumors), pelvic surgery, acute or exacerbation of chronic inflammatory genitourinary diseases; malignant neoplasms; skin diseases in the active phase, sexually transmitted diseases, neuropsychiatric disorders.

The baseline clinical assessment included detailed medical history to identify risk factors for pelvic floor dysfunction before and after childbirth, a thorough analysis of complaints, parity, body mass index, history of perineal injury and some chronic diseases that may be associated with pelvic floor dysfunction.

Diagnostic workup also included physical examination and bimanual vaginal examination, analysis of outpatient colposcopy findings, cervical cytology test, vaginal discharge culture, and laboratory tests. All participants were administered specialized questionnaires. The PFDI-20 (Pelvic Floor Distress Inventory) questionnaire was used to assess the symptoms of prolapse and measure the degree of distress caused by prolapse, urinary and colorectal-anal symptoms. The overall summary score of the PFDI-20 ranges from 0 to 300. The FSFI-19 (Female Sexual Function Index) questionnaire was used to assess six domains of sexual functioning including desire, arousal, lubrication, orgasm, global satisfaction, and pain. Quantitative assessment of the test results is not provided; optimal result is the maximum score for each domain. The PISQ-12 (Pelvic Organ Prolapse and Incontinence Sexual Function Questionnaire) questionnaire was used to measure sexual function in women who suffer from pelvic organ prolapse and/or urinary incontinence. Depending on the total PISQ-12 score, the results were interpreted as follows: from 0 to 10 – deterioration of sexual function; from 11 to 20 – no changes in sexual function, from 21 to 30 – improvement of sexual function, from 31 to 40 – good sexual function and from 41 to 48 – excellent result [19].

When assessing the role of connective tissue dysplasia (CTD) as one of the significant risk factors for pelvic floor dysfunction, we used special criteria for diagnosing the pathology of connective tissue [20]. These criteria are divided into 3 groups: small signs, large signs and severe manifestations of CTD (table). For each criterion in the three groups, 1, 2 and 3 points were assigned, respectively. The score 9 was estimated as mild, from 10 to 16 as moderate, and from 17 and more as high grade CTD.

The assessment of the perineum before and after the rehabilitation program included visual inspection with measurements of the introitus length and perineum height, the presence of gaping introitus, the degree of the vulvar ring dilation by stretching it with the index and middle fingers, assessment of old scars, and the presence of hemorrhoids. Fecal and urinary incontinence was diagnosed by having the patient perform a cough test and a Valsalva maneuver [21]. The stage of prolapse was determined based on the POP-Q (Pelvic Organ Prolapse Quantification System). Assessment of pelvic floor muscle strength was carried out during bimanual examination by the intensity of their voluntary contraction while excluding the contraction of the abdominal, buttock and thigh muscles. Contraction strength of mm. levator ani was estimated using the Oxford Grading system [22].

Among the objective methods, special attention was paid to perineometry, transvaginal and transperineal ultrasound. Perineometry was performed by a digital

perineometer according to the following procedure: a silicone sensor was introduced 7–8 cm in the vagina, followed by air injection in the balloon up to 55 mmHg. Further, the result was registered while requesting the patient to increase the pressure by squeezing (contracting) anal muscles as hard as possible for at least 2 seconds.

The transperineal ultrasound examination was used to register the following parameters: the deviation of the long axis of the urethra from the vertical axis at rest (α) and during the Valsalva maneuver (α1), the posterior urethrovesical angle at rest (β), angle β deviation during the Valsalva maneuver (β1), thickness of *m. Bulbocavernosus* and *m. Puborectalis*, and the height of the centrum tendineum of the perineum.

Patients in the study group started postpartum pelvic floor rehabilitation four weeks after childbirth with the entire follow-up lasting for three months. Patients from both groups were advised on lifestyle modification, nutrition, compliance with physical activity and rest.

The patients of the study group performed pelvic floor training using the portable electric stimulator "SensaTONE" (China) for three months, daily for 30 minutes in the muscle strengthening mode. The current and voltage were regulated by the patient, ranging 0–80 mAh and 0–40 volts, respectively (14-level grading). The output pulse width was 200μs. The output pulses were alternatively switched on and off for 5 seconds. The output frequency/duration was as follows: 10 Hz/5 min, 35 Hz/5 min, 50 Hz/10 min, and 35 Hz/5 min.

Concurrently with electric stimulation, patients of the study group were administered a course of radiofrequency lifting using the 4.0 MHz Surgitron DF S5 (USA) by Pelleve technology. Radiofrequency energy was delivered to labia majora and labia minora for labia tissue tightening, providing the lifting effect, narrowing the vaginal introitus, improving local circulation, eliminating gaping introitus and improving sexual function.

The course of radiofrequency lifting comprised four 25 minute sessions performed at two week intervals. The frequency of radiowave exposure was 4 MHz with the intensity of 20 units. The process of collagen synthesis in the skin takes on average 3–4 weeks, and the recommended interval between aesthetic procedures for neocollagenogenesis stimulation is 21 days. However, some researchers [15, 16] reported the effectiveness of non-invasive and non-ablative modalities for tightening the intimate area at shorter intervals (7 days) between procedures. Based on this, we have chosen the aforementioned treatment schedule with two-week intervals to achieve the most positive lifting effect in a shorter time, which, in our opinion, should improve the patient's compliance.

After completing the postpartum pelvic floor rehabilitation program, we analyzed the patients' complaints, the results of the perineal and perineometric assessment, and the transperineal ultrasound data.

Statistical analysis was performed using Microsoft Word, Microsoft Excel and Statistica v. 7 software. If the distribution of the data was not normal, the nonparametric Mann-Whitney U-test was used.

Results

The results were assessed before and after childbirth among the patients of the study and control groups in the outpatient settings. A re-evaluation of the results was carried out after the completion of the rehabilitation program to compare the results between groups.

Evaluation of possible risk factors for the development of pelvic floor dysfunction in women before delivery included assessment of parity, age, overweight, descent of internal genital organs from their normal positions, predisposition to constipation, voiding dysfunction, gaping introitus, recurrent microbiocenosis disorders, chronic cystitis, symptoms of CTD, perineal trauma in previous births, anemia, and varicose veins. Most of the study participants were Para 1 (35.3%) and Para 2 (52.9%). The proportion of patients older than 30 years of age was 26.4%. Nineteen patients (55.9%) had a body mass index exceeding the normal weight range.

Clinical assessment showed that 32.4% of women had POP-Q stage1pelvic organ prolapse; 35.3%, 52.9% and 61.8% of patients had gaping introitus, predisposition to constipation, and a history of varicose veins, respectively. Small signs of CTD were found in 25 patients (75.3%).

Among obstetric risk factors for the development of pelvic floor dysfunction, we analyzed the following parameters: the length of the second stage of labor, soft tissue tears of the birth canal, episiotomy, and newborn birth weight. In 75.3% of study participants, the length of the second stage of labor was within the physiological range, and only 23.5% of women experienced rapid labor. A history of precipitous labor was found in no more than 1% of cases. However, soft tissue tears of the birth canal occurred in 38.2% of women. Fourteen patients (41.2%) underwent episiotomy, including eight women in the study group and six patients in the control group. Less than 1% of study participants experienced the vaginal delivery of the large fetus.

An analysis of the complaints of the patients of the study and control groups in the late postpartum period and three months after the baseline assessment showed a significant decrease in the symptoms of pelvic floor dysfunction in the study group ($p < 0.001$). The changes in the complaints of the patients of the control group were statistically insignificant ($p > 0.05$) (table).

Responses to the PFDI-20 questionnaire suggested a significant improvement in symptoms of prolapse ($p < 0.05$): the mean score in the study group was 80 before and 65 after rehabilitation; in the control group 78 and 76, respectively (Figure 1).

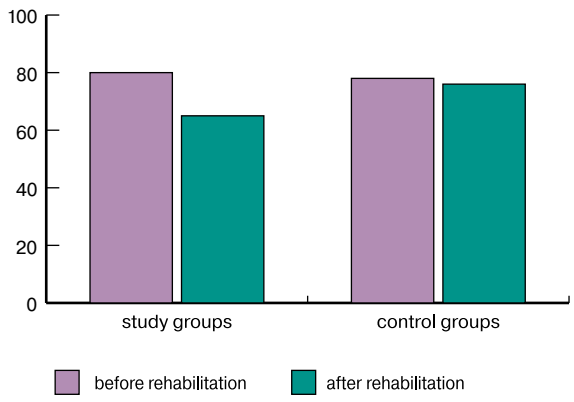
According to the FSFI-19 questionnaire, electrical stimulation of pelvic floor muscles combined with the radiofrequency lifting of labia majora, labia minora, and clitoral region resulted in improvement in the sexual function in 12 patients (66.7%) of the study group. In the control group, 11 (68.8%) patients had no significant changes ($p > 0.05$); 5 (31.2%) patients improved their results.

The questionnaire PISQ-12 demonstrated an improvement in sexual function after the rehabilitation program in 38.9% of patients with a good result in 22.2% and excellent results in 11.1% of cases.

Sixteen patients had signs of CTD. Mild, moderate, and high grade CTD were found in 12, 3, and 1patients, respectively.

Among the subjective parameters, visual assessment of the perineal area after the rehabilitation program identified increased tightness of the labia majora, lifting of the labia minora, reducing of the gaping introitus, and narrowing of the entrance to the vagina, which was observed in 10 patients of the study group (55.6 %). In 7 (43.8%) patients of the control group who had a gaping introitus before delivery, no visible improvement in the perineal area was observed in the late postpartum period. In the control group, the percentage of patients with a gaping introitus that occurred after delivery increased by 25%. In 8 patients of the study group who had an episiotomy (57.1%), no edema, hyperemia or infiltration of the perineal skin was noted in the area of suturing.

Figure 1. Mean PFDI-20 score in the study and control groups before and after rehabilitation



In the patients of the study group, mean contraction strength of the pelvic floor muscles before and after the rehabilitation program was 2.66 and 3.44 points, respectively, which significantly differed from those in the control group (2.97 and 3.05 points at three months after the baseline examination), $p < 0.05$.

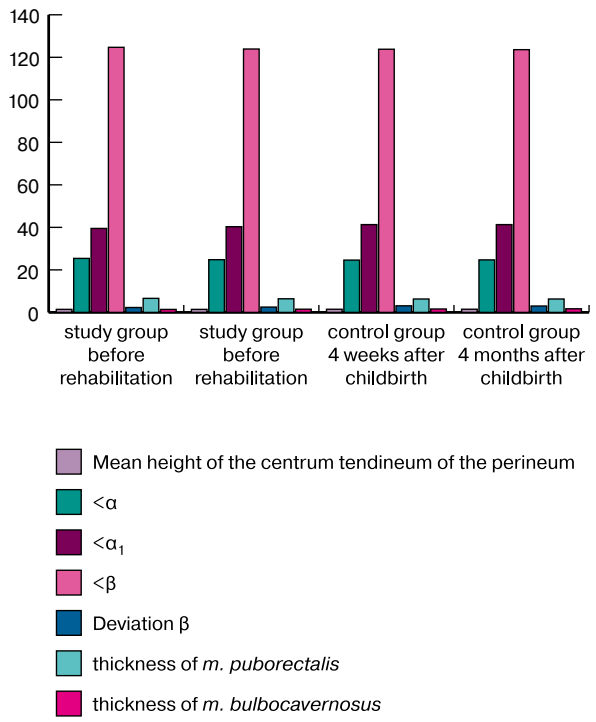
According to the perineometry, mean contraction strength of the pelvic floor muscles three weeks after childbirth was 57.8 and 58.8 mmHg in the patients of the study group and control group, respectively. A reassessment of this parameter after the completion of the rehabilitation program revealed a significant increase in the mean perineal muscle contraction strength in the study group compared with control group (69.8 mmHg and 61 mmHg, respectively; $p < 0.05$).

At week 4 after childbirth, the results of transperineal ultrasound did not differ significantly between the groups ($p < 0.05$). The criteria for evaluating ultrasound parameters used in this study are based on the data reported by M.A. Chechneva [23]. The mean the height of the centrum tendineum of the perineum in the patients of the study group was 1.43 cm 4 weeks after birth, which is somewhat below the normal range (2–2.5 cm). The mean angles $<\alpha$ and $<\alpha_1$ were 25.4° and 39.5°, respectively; Angle $<\beta$ was 124.7°, mean deviation of angle β during the Valsalva maneuver was 2.3°. The average thickness of *m. Bulbocavernosus* was 1.4 cm. The patients of the study group showed a marked decrease in thickness of *m. Puborectalis*, averaging 6.6 mm. There was no significant change in ultrasound parameters in the patients of the study group before and after the postpartum pelvic floor dysfunction rehabilitation program ($p > 0.05$). Changes in transperineal ultrasound findings observed 4 months after childbirth did not differ statistically significantly between groups (Fig. 2).

Table. Changes in complaints among patients of both groups

Complaints	Before childbirth		4 months after childbirth	
	Study group, n=18	Control group, n=16	Study group, n=18	Control group, n=16
Pulling lower abdominal pain	11	8	3	6
Stress urinary incontinence	3	2	0	2
Urinary frequency	11	13	3	11
Nocturia	1	1	0	1
The feeling of incomplete bladder emptying	8	6	2	5
Urinary urgency	1	0	0	2
Loss of urge to urinate	4	3	0	2
Numbness in the perineum	11	8	3	6
Predisposition to constipation	9	11	5	9
Exacerbation of chronic hemorrhoids	13	11	4	9
The feeling of an incomplete bowel movement	8	6	2	5
Anal incontinence	0	0	0	0
Painful bowel movements	10	6	3	4
Dyspareunia	16	12	5	10
Anorgasmia	15	12	6	12
“Gas-like” sounds during intercourse	14	12	9	12

Figure 2. Results of transperineal ultrasound in patients of the study and control groups



Discussion

Analysis of possible causes of pelvic floor dysfunction confirmed the role of risk factors such as varicose veins, overweight, chronic constipation, CTD, soft tissue tears and episiotomy in previous and present births. No relationship was found between the length of the second period of labor, the newborn bodyweight and pelvic floor dysfunction in the late postpartum period. Responses to the questionnaires suggest a significant decrease in symptoms of pelvic floor dysfunction ($p < 0.05$) in patients undergoing electrical stimulation of pelvic floor muscles combined with the radiofrequency lifting of the perineal area compared with the control group. Results of perineometry and assessment of pelvic floor muscle strength by the Oxford grading system showed a significant increase in the contraction strength of the pelvic floor muscles in the patients of the study group, compared with patients in the control group ($p < 0.05$). Changes in transperineal ultrasound parameters observed three months after the start of the rehabilitation program did not differ statistically significantly between groups. This fact can be explained by an insignificant initial deviation of the ultrasound parameters from the normal range in the study participants.

Conclusion

Symptoms of pelvic floor dysfunction of the late postpartum period require correction, as they have a negative impact on all areas of the patient's life. Our findings suggest that treating vulvar and perineal tissue by radiofrequency energy using the 4.0 MHz Surgitron DF S5 by Pelleve technology concurrently with portable electrical stimulation of perineal muscles are quite effective as it is a combined technique, affecting several levels: the vulva, perineal tissues, and cross-striated muscles of the pelvic floor.

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