

Research article

Pilot study on urinary incontinence rehabilitation using non-invasive methods

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Abstract: Urinary incontinence affects up to a quarter of the female population at an active age of over 40 years old. The rate increases by 40% for females over 60 years old. Medical rehabilitation regarding stress, urge or mixed geriatric urinary incontinence pathologies by using physical, non-invasive methods is poorly reported in literature, even though the obtained results are quantifiable, consistent, durable through continuous and periodic exercise. The objectives of rehabilitation of stress urinary incontinence, urge incontinence and mixed stress and urge urinary incontinence are the conscious toning of muscles of the pelvic floor, patient's awareness of contractions thereof, and the improvement of these patients' quality of life. Toning the muscles of the pelvic floor is essential in stress urinary incontinence whereas in urge incontinence it may increase urination control. Physical exercises increase the muscle tonus of the pubococcygeus muscles surrounding the vagina and the anus, and whose contraction may stop the evacuated quantity of urine, faeces and gases. The first-line treatment is the Kegel perineal reeducation, with a preventive and curative role in the treatment of urinary incontinence, also during the first and second stage of genital prolapse. Reeducation, supervision, guidance, relaxation, and exercise are essential elements in the reduction of urinary incontinence or prolapse in nascent stages. In literature and in practice there are several approaches to pelvic rehabilitation: some are minimally invasive, while others are non-invasive. In the current investigation, a group of elderly patients with stress, neurological or/and mixed urinary incontinence—which was linked to a mild genital prolapse in the female patients—were treated with four minimally invasive and non-invasive techniques. Associated comorbidities were type II diabetes (ADO treated) and a previous ischemic stroke in antecedents. Kegel exercises will be supplemented by transcutaneous electrical neurostimulation. Electrical neurostimulation also brings non painful electrical stimulation thus producing the contraction of the external sphincter muscle of urethra and the levator ani muscle inducing the inhibition of the detrusor muscle and of the contraction of the urinary bladder. After a 3-4 week training, subjective improvements and the spacing out of urinations to 3-4 hours are registered. The continuation of treatment up to 2 months (60 days) additionally improves patients' functional status, thus substantiating and stabilizing the obtained results over time. Positive outcomes were attained, as the patient was able to effectively complete the pelvic rehabilitation course of action. Urinary losses could be completely eliminated and the number of nighttime bath-room visits was lowered to the recommended physiological threshold (one awakening per night).
Keywords: prepuberty, posture abnormalities, scoliosis, somatoscopy, physiotherapeutic assessment

Keywords: bladder, urinary, incontinence, detrusor muscle, Kegel, pelvic, non-invasive, rehabilitation, electrical neurostimulation, geriatric

1. Introduction

The prevalence of urinary incontinence in Western countries is approximated to a minimum of 5% of the general population [1,2], the approximations progressively increasing the reference values to 25-45% [3,4] in the case of geriatric patients in the 55-75 year age group. In the case of females over the age of 70, said prevalence increases by

over 50% [4]. Moreover, it is a known fact that urinary incontinence is more frequent in the case of females. It is appreciated that 9% of them suffer from uncontrollable urinary losses, whilst males account for only 1.6% [5]. Statistics show that 10 % up to 35% of adults and almost 50% of the institutionalized individuals are affected. An important justification of these imprecise data is the social stigmata which, in reality, makes people suffering from urinary incontinence to delay their visit to the specialist by 6 to 9 years or 50% up to 70% of the women having these specific manifestations to hide this problem. According to statistical assessments, only a small percentage of patients seek medical attention because of factors such as lack of information, personal shame, etc. [6,7]. The frequency of occurrence for these pathologies increases with the number of pregnancies, births, age, sedentary lifestyle, overweight, and even obesity. Studies using statistics have discovered that the most significant impact on an individual's overall health is caused by urinary incontinence, which also has a significant impact on social interactions and the cost of social and medical services. In diagnostic practice there are 6 types of urinary incontinence: effort incontinence, urge incontinence, mixed incontinence, overflow incontinence, total incontinence, and enuresis. On the other hand, we have four pathological stages : stage 0 – no clinical signs; stage 1 – they lose urine during effort and the basis of the urinary bladder lowers by less than 2 cm against the upper edge of the pubic bones; stage 2 – the urinary bladder lowers by more than 2 cm, and they lose urine during effort; stage 3 – they lose urine at rest (intrinsic sphincteric deficiency).[8] Urinary incontinence frequently appears following the decrease of toning of the pelvic muscles supporting the bladder, and of the sphincter muscle controlling the urinary flow being caused by dysfunctions of the pelvic floor, the muscle group supporting the urinary bladder, the uterus and/or the prostate, and also by the decrease of toning of detrusor muscle, the muscle of the urinary bladder in charge with the emptying thereof. The weakening of the muscles of the pelvic floor (levator ani) results in pelvic prolapse and effort incontinence, urge or mixed incontinence over time. To tone up these muscles, the patient must be taught Kegel exercises, the KNAK method, The Stop-Pee method which result in the invigoration of the external urinary sphincter. Contraction of buttock muscles and the abdominal wall during exercises is a mistake that must be avoided. Urinary bladder "training" is a method of self-education, re-awareness of the urination process while combining distraction and relaxation strategies with diet, therefore it must be conducted by experienced personnel. [4,9]. Disorders or dysfunctions of the sympathetic nervous system that may have psychogenic causes or dysfunctions of the vegetative balance may frequently represent causes for a hyperactive urinary bladder. Perineal reeducation, the first line treatment having a preventive and curative role in the treatment of urinary incontinence and of stage 1 and 2 genital prolapse, will be completed with parasacral transcutaneous electrical neurostimulation, aimed at modulating the activity of the bladder detrusor through transcutaneous electrical neurostimulation. Electrical neurostimulation also brings non painful electrical stimulation thus producing the contraction of the external sphincter muscle of urethra and the levator ani muscle inducing the inhibition of the detrusor muscle and of the contraction of the urinary bladder. After a 3-4 week training, subjective improvements and the spacing out of urinations to 3-4 hours are registered. The continuation of treatment up to 2 months (60 days) additionally improves patients' functional status, thus substantiating and stabilizing the obtained results over time.

2. Results

2.1. Characteristics of the patients (age, gender, environment)

Table 1. Characteristics of the patients in the study group

| | No. | Percentage (%) | Min/Max age (years) | MD±DS |
|-------------------|----------------------|--------------------|---------------------|--------------|
| Gender (F/M) | 67 women 3 men | 95.71 % 4.29 % | | |
| Age (years) | | | 55 - 75 | 64.93 ± 6.02 |
| Environment (U/R) | 38 urban 32 rural | 54.28 % 45.72 % | | |

2.2. Results obtained after using the treatment

The results obtained were as follows: diuresis increased more significantly in the second group that additionally received parasacral transcutaneous electrical neurostimulation, as shown in Figure 1.

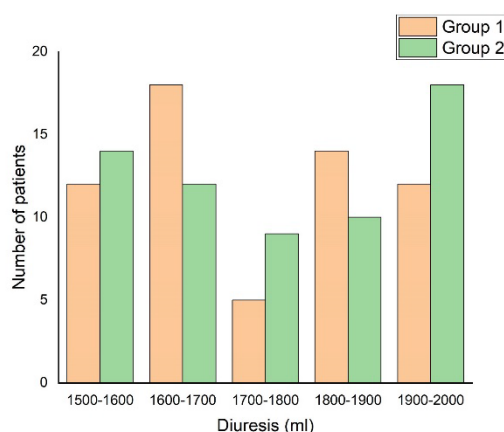


Figure 1. Diuresis: 1500-1600 ml, 1600-1700 ml upon arrival, 1700-1800 ml, 1800-1900 ml, 1900-2000 ml on day 60.

We note that although when coming all patients in the two groups complained of an increased number of urinary needs during the day (14-16), following the use of treatment, both groups of patients registered a decrease in the number of urinary needs: patients from group 1 and 2 had a reduction of the number of urinations to 7-9 per day, thus falling within the physiological number of urinations per day. A small number of patients from both group 1 (8 patients) and group 2 (2 patients) of the study recorded a decrease in the number of urinations per day (7-9 urinations). Finally, a significant number (27 patients from group 1 and 33 patients from group 2) returned to the physiological number of daily urinations. We notice that a considerable number of patients in group 2 (33) recorded the number of physiological urinations compared to group 1, where only 27 patients recorded a drastic decrease in the number of daily physiological urinations, which shows the increased efficiency of the additional parasacral transcutaneous electrical neurostimulation. (figure 2 (a))

At the same time, we observe a drastic decrease in the number of urinations at night to 1-2 with a more significant number of patients who present this behavior in the second group, the one that additionally received the parasacral transcutaneous neurostimulation treatment. (figure 2 (b))

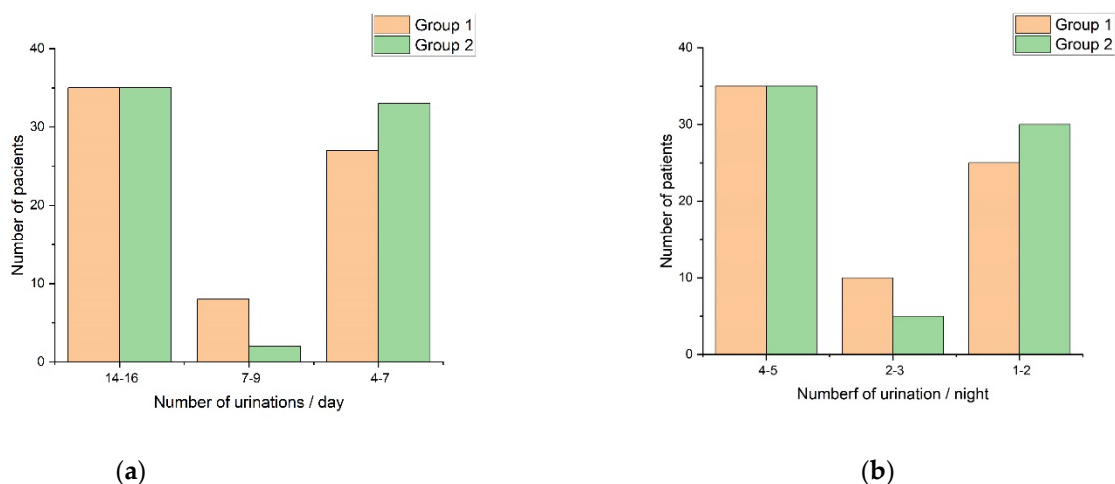


Figure 2. (a) Number of urinations per day (b) Number of urinations per night

In terms of urinary losses, patients in groups 1 and 2 reported 40–70 milliliters lost through urination. After using the treatment, 12 patients from group 1 and 2 patients from group 2 recorded approximately 10 ml of urinary loss; the rest of the patients, 23 patients from group 1 and 33 patients from group 2, declared that they no longer recorded urinary loss at all. We observe the consistent number of patients in group 2 who declared 0 urinary losses, thus underlining the effectiveness of sacral transcutaneous neurostimulation treatment.

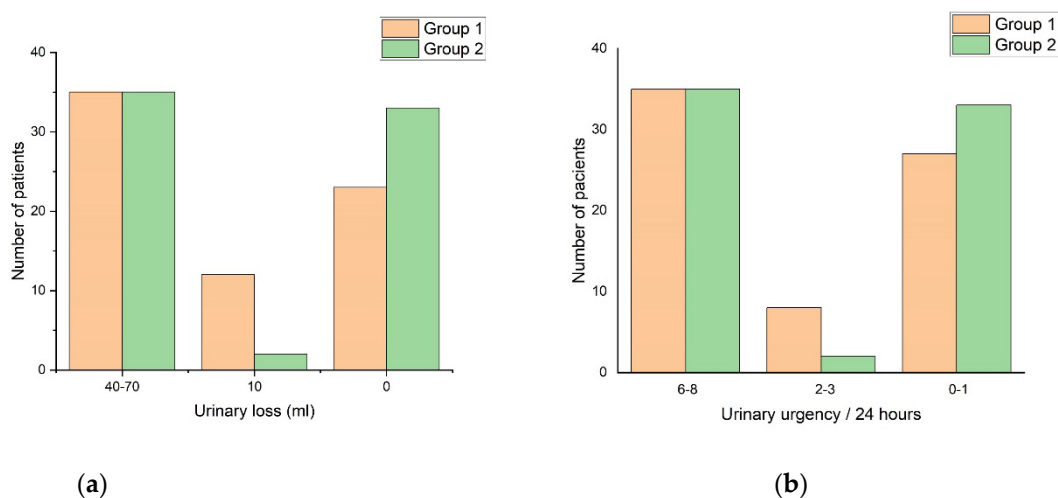


Figure 3. (a) Quantity of urinary loss in ml (b) Number of urinary urgency per 24 hours

3. Discussion

We observe a drastic decrease in the score regarding the bladder control questionnaire, from 9 (upon arrival) to 1 (on day 60). Figures 1, 2, and 3 show us that the patient is in the lower part of the range falling between 1 and 3 (no issues with urinary control). Furthermore, we can observe that the patients in work group 2, who were more successful in using the complex and comprehensive treatment (which included parasacral transcutaneous electrical stimulation as well), were treated more effectively than the patients in group 1 who gained only specific physical therapy. Moreover, as regards the experienced discomfort, the value decreased to 0 (not bothered by urinary problems.) Every six months or after three sessions in total, new treatment sessions must be undertaken in order to sustain the constant long-term benefits. The questionnaire to assess bladder control (Table 3) additionally contains the following indications: (1) for a score higher than 4 in the first column, a physician should be consulted; (2) for a score higher than 1 in the last column, the patient will start feeling better if they receive professional medical treatment. Literature existing from the perspective of using a similar treatment is

defective. Literature approaches topics from the perspective of diagnosis, manifestations and symptoms or of correlations with other comorbidities or of surgical treatment. Or, before using a last-intent surgical treatment, we have noninvasive treatments that may be used successfully for the patients whose quality of life has been affected by the urine loss issues. As for the noninvasive treatments addressing the effort incontinence, neurological incontinence or even mixed incontinence, literature refers either to the kinetic option including Kegel exercises or to the electrical stimulation of the pelvic floor muscles. Electrical neurostimulation also brings non painful electrical stimulation thus producing the contraction of the external sphincter muscle of urethra and the levator ani muscle inducing the inhibition of the detrusor muscle and of the contraction of the urinary bladder. After a 3-4 week training, subjective improvements and the spacing out of urinations to 3-4 hours are registered. The continuation of treatment up to 2 months (60 days) additionally improves patients' functional status, thus substantiating and stabilizing the obtained results over time. The simultaneous use of the two types of treatments, namely the specific functional kinetic therapy of the pelvic floor and the electrical neurostimulation of the detrusor muscle through sacral approach belongs to us, and it is unique within this study. Taking into consideration the ease of using this treatment, its noninvasive character both from the biological viewpoint and from the point of view of patient's intimacy, this kind of complex treatment provides perspectives for efficient treatment of patients and the increase of their quality of life. This type of treatment is easy to use even in the small rehabilitation practices, thus facilitating patients' access to the treatment of urinary incontinence ever since the onset of their first symptoms, without their waiting for years to get a treatment and have a better quality of life.

4. Materials and Methods

The 14-month Pilot Study was carried out at "Domenico" Medical Center of Iasi from January 1, 2018 to April 30, 2019. It involved 70 patients with stage 1 or 2 mixed urinary incontinence. .

The seventy-five patients aged between 55 and 75 came to the rehabilitation center with a diagnosis of urinary incontinence or mixed urinary incontinence and stage 1 genital prolapse in the case of women, and harmful urinary tract infection, some of them also having associated comorbidities such as type 2 diabetes ADO treated and a previous ischemic stroke without disabling and debilitating consequences. After 30 to 60 days, every patient understood their history of urine loss. The mixed urinary incontinence diagnosis resulted in a routine gynecological check-up, which is annually performed for post-menopause monitoring and cancer prevention.

The inclusion criteria were: patients diagnosed with stage 1 or 2 stress, urge and mixed urinary loss/incontinence.

The exclusion criteria were: patients with urinary tract infection, and associated comorbidities such as type 2 diabetes insulin-dependent, and a previous ischemic stroke with disabling and debilitating consequences.

The 70 patients were divided into 2 groups of 35 patients each. The first three therapy techniques/methods listed below were used for Group 1 as part of their treatment. The 2nd group of patients received a treatment consisting of the 3 methods/techniques shown above, the treatment being supplemented/completed with parasacral transcutaneous electrical neurostimulation.

Four non-invasive perineal reeducation methods were simultaneously applied:

4.1. Kegel gymnastics seeks to retrain the pelvic muscles by separating them from the abdominal muscles through awareness-building.

The exercises are being taught in the recovery office in order to be correctly explained by the kinetic therapist and understood and performed by the patient. Afterwards, they are regularly carried out by the patient at home. It is advised to combine these workouts with abdominal exercises, particularly for the lower abdomen. The technique is applied using a simultaneous contraction of the pelvic/anal plate and one of the lower abdomen, the maintenance of the contraction for 3-5 seconds, followed by relaxation for similar time

intervals. Breathing ought to be spontaneous, free of apnea, throughout this whole duration. The exercises must be repeated three times daily, in sets of 20 repetitions. After seven days of the rehabilitation program, consistent execution yields the initial results; however, the method must not be abandoned; rather, it must be incorporated into the patient's daily routine. The patient was instructed as follows: a muscle contraction for 10-15 seconds followed by relaxation for the same period, succeeding the phase until 10-12 minutes are reached. Afterwards, rapid and successive contractions and relaxations (1-2 seconds) are carried out. Other variations of contraction/relaxation times may be used, with a progressive increase in the execution intervals.

4.2. The KNAK method is a long-term tedious learning process, but it cannot be abandoned if the patient desires to control urinary losses during physical effort. The technique consists of a voluntary blocking of the perineum immediately before the physical effort, being an automatic response of the patient to effort – a passive mechanism. The technique seeks to restrict the base of the bladder and the cervix descent. The patient is first requested to do a perineal contraction after being placed in an abdominal hypertension scenario (sneezing, coughing, etc.). Subsequently, this situation will be renewed without a previous contraction. The aim is for the pelvic muscles to react through a contraction.

4.3. The Stop-Pee method consists of a voluntary stop of the urine stream during urination when the bladder is not entirely empty. The technique is used for building awareness of the perineal muscles. It suggests that the patient should identify and begin to build awareness of the pelvic and perineal muscles, beginning with brief contractions (for building awareness), subsequently and gradually increasing the contraction frequency and maintenance duration.

4.4. The parasacral transcutaneous electrical neurostimulation is a non-medicated and non-invasive alternative, indicating the hyperactivity of the detrusor muscle, which coats the bladder and coordinates its activity [10]. The bladder and the internal urethral sphincter, which are controlled by the sympathetic nervous system, decide when to expand the bladder's capacity without putting further strain on the detrusor. They stimulate the internal urinary sphincter to remain closed, thus inhibiting urination [11, 12]. The parasympathetic system has the opposite action of the sympathetic nerve, stimulating the detrusor to contract. The spinal cord regulates these nerve branches. The somatic nervous system allows for the voluntary control of the actions of the muscles – the external urethral sphincter and the pelvic diaphragm. The method is based on the action of nervous impulses transmitted through electrical neurostimulation to the lumbar and sacral jumpy pathways. This technique inhibits the excitatory parasympathetic reflex and acts to activate the inhibitory sympathetic reflex. The intervention focuses on the perineal nerve (somatic), which is under voluntary control (S2-S3), and the pelvic nerve (parasympathetic), where unopposed impulses cause detrusor contraction (L2-L3). These will determine the decrease and even stopping of involuntary contractions of the bladder detrusor. The method is non-invasive, pain-free, efficient, and easy to apply. The technique can also be used to treat polysymptomatic nocturnal enuresis by using electrical current with a frequency of 10Hz and pulses of 700ms applied for 20 minutes in the presacral region. It can be done in one weekly session or three weekly sessions, making it feasible to increase the number of dry days following the 60th day of treatment. This comes to a total of twenty-four therapy sessions. Presacral transcutaneous electrical neurostimulation is a relatively new method for treating urinary incontinence, mainly used for the hyperactivity of the bladder in children. It is generally opted to apply electrostimulation in single weekly sessions to raise child compliance to the treatment. To get quick and long-lasting benefits, it is preferable to choose the three-session weekly treatment option for adult and elderly patients. The treatment schedule considers the physiological aging of the organs, muscles and nerves as well as the presence of comorbidities, which commonly happens when geriatric patients are involved. As a result, the bilateral paravertebral region of L3 was electrostimulated. A stimulator for particular sites and a Point Select Digital DT device (Figure 4) with a differential localization probe were used. The device allows the usage of the probe to precisely detect a stimulation point,

manually or automatically, depending on the settings. Following the precise localization of the stimulation points, the same probe is used to emit the electrical current, with a range of feasible options available: Nogier frequencies, Bahr frequencies, or other frequencies. The technical specifications of the device are the following: operating frequency range: 2 – 128 Hz, impulse duration: 60 – 120 μ s, intensity: 28 mA, power supply: 9 V.



Figure 3. Pointoselect Digital DT device, Pierenkemper GmbH, Germany, 2014

In order to sustain long-term benefits, it is recommended that these perineal rehabilitation techniques be repeated every six months and that perineal Kegel exercises be performed at home, precisely as directed by the physical therapist during the treatment period. Therefore, the goal is to prevent losing the functional outcomes that were achieved during treatment sessions.

The dietary and hygienic regimen correlated with any of the perineal reeducation methods aims at the maintenance of optimal muscle function (and even an increase in muscle mass and capacity) in the perineal area; keeping the body mass index under 25, a balanced diet, the prevention of constipation, the avoidance of significant physical efforts (lifting weights heavier than 3-4 kg), smoking cessation and the reasonable consumption of 2 liters of liquids daily (with a limitation of liquid intake after 8:00 p.m.) may also help in this respect.

Two questionnaires were used and implemented for the patients in order to quantify the outcomes obtained: one sheet for bladder control assessment and a three-day urinary calendar. They were both applied twice: in the first instance when the patient came at the recovery clinic, and then at the end of a treatment session.

Table 3. Assessment of the discomfort score

| Score | Symptom score result | Discomfort score result | Score |
|-------|----------------------------------|----------------------------------|-------|
| 0 | no problems with urinary control | not bothered by urinary problems | 0 |
| 1-3 | with slight problems | slightly bothered | 1-3 |
| 4-6 | with moderate problems | moderately bothered | 4-6 |
| 7-9 | with significant problems | bothered | 7-9 |
| 10-12 | with important problems | significantly bothered | 10-12 |

¹ cc

We observe a drastic decrease of the score in the the bladder control questionnaire, from 9 (upon arrival) to 1 (on day 60). According to Table 3, we notice that the patient falls within the limit of 1-3 (no problems with urine control), namely in the lower limit of the range. Moreover, regarding the experienced discomfort, the value decreased to 0 (not bothered by urinary problems). Every six months, or after three sessions in total, new treatment sessions must be undertaken in order to sustain the constant long-term benefits. The questionnaire assessing bladder control (Table 3) additionally contains the following indications: (1) for a score higher than 4 in the first column, a physician should be

consulted; (2) for a score higher than 1 in the last column, the patient will start feeling better if they receive professional treatment.

This is considered to be a pilot study in medical rehabilitation, a preliminary test aiming to assess the feasibility thereof and to identify any potential issues and aspects before conducting a wider study on the physiotherapeutic noninvasive treatment used in the rehabilitation of urinary incontinence by noninvasive methods.

The statistic analysis for this study was carried out by using Origin Lab version 2019.

A search of the Medline/PubMed electronic database was performed for dates up to February 2024. The search terms used included “urinary incontinence” and “diagnosis” or “non-surgical management” or “conservative management” or “drug treatment” or “behavioral therapy” or “physical therapy”. Further studies were chosen on the basis of manual searches of reference lists and review papers and from meetings of the European Association of Urology (EAU), the American Urological Association (AUA), the Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction (SUFU) and the International Continence Society (ICS). Various guideline organizations were also searched for existing practice guidelines and systematic reviews on diagnosis and non-surgical management of urinary incontinence.

5. Conclusions

Imperious urge to urinate and incontinence episodes represent an alteration of the quality of life in the patients suffering from urinary incontinence. The melioration of the function of the lower urinary system requires a compliant patient, and also an empathetic physical therapist who must study the anamnesis in order to understand and modify patient’s behaviour. Urination calendar is an essential instrument for this purpose. The second step of this treatment is the association of transcutaneous electrical neurostimulation to the behavioral therapy. The new ICS definitions make it easier to use medical terms in the relationship with the patient, and evens out the concept of hyperactive bladder and hyperactive detrusor for the medical research.

We noticed an increase in the effectiveness of the treatment applied to the 2nd study group through transcutaneous parasacral electrical stimulation of the detrusor muscle, in addition to specific pelvic gymnastics done regularly.

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Informed Consent Statement: Informed consent was received from all subjects involved in the study. The patient(s) has(have) given their written informed consent for this paper to be published.

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