Assessment of the impact of endovaginal electrostimulation and exercises on the pelvic floor muscles bioelectrical activity in a young, healthy woman – a case report

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Abstract

Background: In Poland and worldwide, many women struggle with dysfunctions of the urogenital system. Therefore, therapeutic methods should be sought that will prove effective in strengthening the pelvic floor muscles (PFM).

Aims: The aim of the study was the electromyographic evaluation of the effect of endovaginal electrical stimulation and exercise on the bioelectrical activity of the PFM in a young woman without urogenital dysfunction.

Case report: The study involved a 20-year-old, childless woman (nulliparous) who did not show dysfunctions within the urogenital system. For the period of 8 weeks, she performed PFM exercises three times a week. In addition, she underwent 24 treatment sessions of PFM electrostimulation using an endovaginal electrode. Before and after the therapeutic intervention, the bioelectrical activity of PFM was measured. After a series of endovaginal electrostimulation treatments and exercises, changes in the bioelectrical activity of the pelvic floor muscles were noted.

Summary: The presented case report shows that endovaginal electrostimulation combined with PFM exercises can be an effective tool influencing the changes in the bioelectrical activity of the pelvic floor muscles. Further clinical trials should be conducted to verify the effectiveness of the proposed physiotherapeutic methods in preventing PFM dysfunction, as well as to determine the appropriate parameters of endovaginal electrical stimulation.

Key words

prevention,
urogenital disorders,
pelvic floor muscles,
endovaginal electrostimulation,
young woman,
case study.

Introduction

The pelvic floor is an extremely important place in the female body. Like any other area of the body, it, too, can undergo various types of dysfunctions related to a disorder of the tension of the muscles there. Two types of these disorders have been distinguished: hypotonia, or decreased tension, and hypertonia, or increased tension [1]. Reduced muscle tone, especially in young women, can result in sexual disorders, which include sexual arousal disorder and anorgasmia. At a later age, during menopause, reduced pelvic floor muscle (PFM) tone can cause urinary and fecal incontinence. Hypotonia is also often faced by women who have given birth vaginally, as well as those who are overweight. In these two groups, it can be the cause of abnormal statics of the reproductive organs, which can manifest as lowering or even prolapse of the reproductive organs [2]. Increased pelvic floor muscle tone can lead to pain in the vulva, bladder, rectum, epigastrium, lumbar spine, groin, and lower extremities [1,3].

Due to its intimate nature, urogenital disorders are still considered by many to be a taboo subject; hence, the prevalence of this type of health problem is determined by estimates. In Poland, the issue of urinary incontinence may affect about 2.5 million people, but this figure may be much higher due to the lack of reliable data. It is worrying that over the last ten years, the number of people worldwide struggling with urinary incontinence has been gradually increasing – for example, in 2008, it was 346 million, while five years later, it was already 383 million [4–7]. Although PFM dysfunctions are not life-threatening, they are among the dysfunctions that significantly reduce quality of life. Women point to feelings of shame, embarrassment, and gradual withdrawal from social, social, and professional life. All of this translates into the fact that female patients are long delayed in seeking help. Studies show that women often go to a specialist about five years after the onset of symptoms [8,9].

Taking into account the above data and the fact that there are many factors influencing the onset of pelvic floor dysfunction, it seems reasonable to look for therapeutic methods that will prove to be effective in strengthening PFM in young, healthy women in order to prevent the occurrence of urogenital dysfunction in later stages of their lives.

Many physiotherapeutic methods have been clinically proven effective in pelvic floor dysfunctions. One of the most well-known methods is physical exercise and training. Dumoulin et al. [10] conducted a systematic review in 2011 and 2015 to analyze the effectiveness of PFM exercises in a group of patients with stress urinary incontinence (SUI). This form of therapeutic intervention received the highest level of scientific evidence, which was confirmed in studies by other authors as well [11–13]. PFM exercises are very often combined with physical therapy to increase the effectiveness of therapy [12,14]. The most well-known treatment is PFM electrostimulation using an endovaginal electrode. The pulse frequency should range between 10-50 Hz, the pulse duration should not exceed 200 μs, the pause time should be two times the applied contraction time, and the intensity should be increased most often to the patient's tolerance limit. However, the available literature lacks studies focusing on using endovaginal electrostimulation to prevent PFM dysfunction in young, healthy women.

Aims

This study aimed to evaluate the effects of endovaginal electrostimulation and exercise on PFM tension using electromyography (EMG) in a young woman demonstrating no urogenital dysfunction.

Case report

The study involved a 20-year-old, childless woman (height = 163 cm, weight = 54.5 kg, BMI = 21 kg/m^2) with no urogenital dysfunction. Before the measurements were taken, a clinical history was completed, based on which it was determined that the woman did not follow any specific diet and led a moderately active lifestyle. The woman was a physiotherapy student who undertook recreational physical activity consisting of playing squash two times a week and participating in ballroom dancing classes once a week. The woman had no chronic illnesses, nor was she taking any permanent medication. Her menstrual cycle was irregular and lasted 26-32 days. The respondent was sexually active and had regular sexual intercourse, during which she experienced no pain. She also did not use hormonal contraception.

In the first stage of the study, the bioelectrical activity of the PFM was measured using an endovaginal electrode (**Fig. 1**) and EMG device integrated computer software (**Fig. 2**). In the woman, the test was conducted in two trials: in the supine position with a wedge placed under the head and knee joints, and in the barefoot standing position. Both trials were conducted with visual control of the tested woman.

Assessment of PFM bioelectrical activity was performed using the Glazer protocol, which consists of 5 steps (activities) [15]:

- One 60-second rest; during this time, the woman was instructed to feel the pelvic floor in the resting position,
- Five 2-second phasic contractions with a 2-second pause between them; the woman was instructed to perform the PFM contraction as quickly as possible and then relax them quickly and completely,
- Five 10-second tonic contractions with a 10-second pause between them; the woman was instructed to perform the PFM contraction, hold it for 10 seconds, and then completely relax the muscles and remain relaxed for 10 seconds as well,
- One 60-second endurance contraction: woman was instructed to perform the PFM contraction at such a level that she was able to maintain it for 60 seconds,
- One 60-second rest; the woman was instructed to feel the pelvic floor again in the resting position.

Pre- and post-test measurements were taken by ensuring the intimacy and privacy of the woman in the same room, under the same conditions, and by the same researcher to avoid measurement errors and improve the reliability of the study.

After measuring PFM bioelectrical activity, the subject performed PFM exercises at home 3 times a week for a period of 8 weeks according to a strict regimen: 9 contractions in a series, 3 series, contraction held for 6 seconds, then relaxation of 12 seconds. At the end of each series, 3 fast PFM contractions lasting 1, 2, and 3 seconds, respectively. There was a 2-minute break between series. The woman conducted PFM training in the supine position with her lower extremities flexed at the hip and knee joints and her upper extremities positioned along her body. Before starting the exercises, the subject was instructed by a physiotherapist on the correct methodology for performing them. When performing the PFM contraction, it is recommended to keep the abdominal muscles, thighs, buttocks, and back extensors relaxed. Attention should also be paid to the breathing method - do not hold your breath when performing a contraction [16]. In addition, the woman, with the help of the biofeedback method, was instructed on how to relax the PFM effectively so that at home, she worked not only on the contraction of the PFM but also on their conscious and effective relaxation.

In addition, the female participant was subjected to 24 treatment sessions of PFM electrostimulation using an endovaginal electrode (**Fig. 3**). A single treatment lasted 20 minutes and used a frequency of 10 Hz, a pulse time of 200 µs, a contraction time of 5 s, a pause time of 10 s, and an intensity up to the participant's tolerance limit. Treatments were carried out 3 times a week for a period of 8 weeks with at least a one-day interval between treatments (excluding weekends and menstrual bleeding days).

After eight weeks of preventive interventions, an increase in PFM bioelectrical activity during five 10-second tonic contractions and one 60-second endurance contraction was observed in standing measurements. In addition, there was a reduction in muscle tone during the second 60-second resting measurement. The results obtained during the measurements before and after therapy in the standing position are shown in **Table 1**. For the measurements taken in the supine position, improvements were noted in all phases, except for the second 60-second resting measurement, where an increase in tension was observed at rest. Changes in PFM bioelectrical activity in the supine position before and after therapy are shown in **Table 2**. The greatest improvement in both the standing and supine positions was noted for five 10-second tonic contractions. In the standing position, there was an increase in bioelectrical activity of 127.86%, and in the case of the supine position, there was an increase of 74.90%. From the measurements, it can also be observed that in the case of the standing position, the woman was able to relax her muscles more effectively in the second 60-second resting measurement, which followed a series of PFM contractions.

In her clinical history after 8 weeks of physiotherapeutic intervention, the woman reported better sensations during sexual intercourse, as well as an end to her problems with defecation - prior to the study, the woman had not had a bowel movement even for a period of 7 days. In addition, despite feeling the need to defecate, she was unable to do so.

Figure 1. Endovaginal profiled electrode PR02 Everyway Medical.

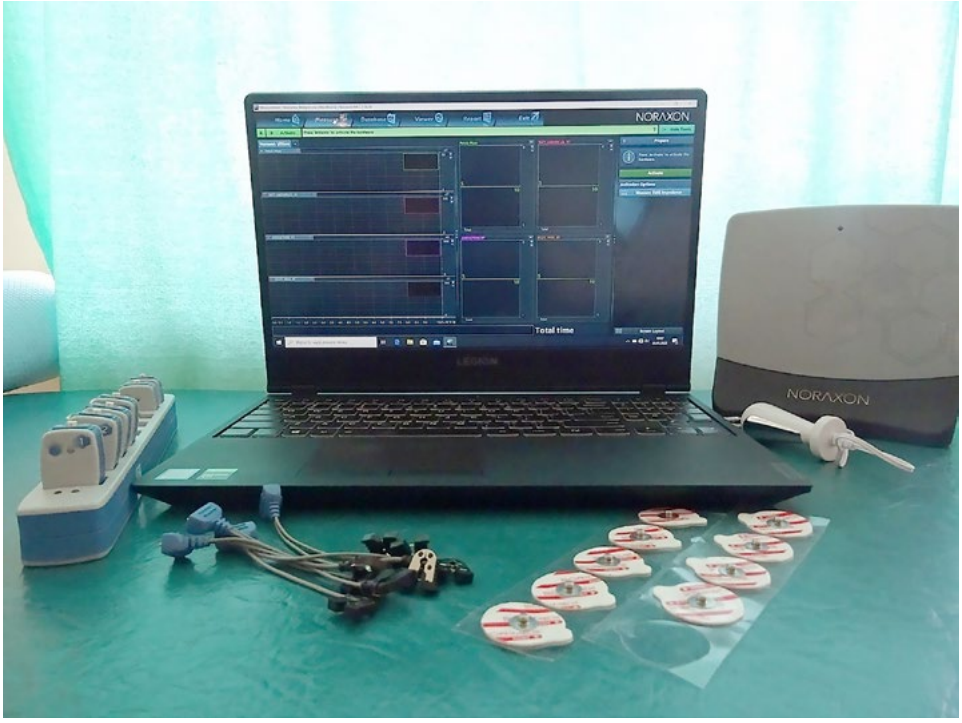

Figure 2. Electromyographic device Noraxon Ultium EMG System.

Figure 3. Electrostimulation EMG device NeuroTrac MyoPlus 2 Pro.

Table 1. Changes in the bioelectrical activity of the PFM in the standing position before and after therapy.

PFM activities following the Glazer protocol	Measurement before therapy [μV]	Measurement after therapy [μV]
One 60-second rest	1.52	3.67
Five 2-second phasic contractions with a 2-second break between them	11.5	10.9
Five 10-second tonic contractions with a 10-second break between them	22.54	51.36
One 60-second endurance contraction	24.5	37.1
One 60-second rest	1.49	0.82

Abbreviations: μV *– microvolt; PFM – pelvic floor muscles.*

Table 2. Changes in the bioelectrical activity of the PFM in the supine position before and after therapy.

PFM activities following the Glazer protocol	Measurement before therapy [μV]	Measurement after therapy [μV]
One 60-second rest	1.55	0.84
Five 2-second phasic contractions with a 2-second break between them	12.3	16.0
Five 10-second tonic contractions with a 10-second break between them	24.46	42.78
One 60-second endurance contraction	26.7	33.5
One 60-second rest	1.57	1.9

Abbreviations: μV *– microvolt; PFM – pelvic floor muscles.*

Discussion

PFM exercises are an essential element in the therapeutic management of dysfunction and preventive measures. Exercises involve learning how to contract the PFM properly, as well as how to relax them effectively. It is by far the most accessible form of therapy, as women can perform the training at home after being properly trained by a physiotherapist. This is supported by a study conducted by Henderson et al. [17], which showed that healthy women and those with minor pelvic floor dysfunctions are able to properly perform muscle contraction when given verbal instruction. The results suggest that for preventive purposes, women can perform PFM exercises on themselves without the participation of a physiotherapist as a part of autotherapy. According to the findings of a systematic review conducted in 2018 [18], the best results of PFM exercises are obtained by women who perform the exercises for 10-45 minutes 3-7 times a week for a minimum of 6 weeks. According to a 2019 systematic review and meta-analysis [19], the number of PFM contractions in a single series should not exceed 9 repetitions. The contraction should be maintained for 5-6 to a maximum of 10 seconds, and the interval between tensions should be between 1-12 seconds and depend on the number of contractions performed. Between series, the interval should be between 1-3 minutes. At the end of each series, the patient should perform 3 or 4 rapid PFM contractions lasting 1, 2, and 3 seconds, respectively. Romeikiene et al. [20], based on their review, confirm that most studies indicate that PFM training conducted in the pre- and postnatal period has a positive effect on preventing pelvic floor dysfunction, particularly incontinence symptoms.

PFM electrostimulation is one of the elements of physical therapy intended to increase the effectiveness of ongoing therapy. In a systematic review, Alouini et al. [21] showed that electrostimulation combined with PFM exercises is effective in treating urinary incontinence and improving quality of life. In contrast, in another review, the researchers concluded that electrostimulation can be effective in increasing the mass and strength of PFM. In addition, it may prove helpful for patients with extremely weak perineal muscles in teaching them to contract correctly [20].

In the case study, changes in PFM bioelectrical activity were observed after 8-weeks of preventive measures. However, the desired effect was not achieved in all parameters. Indeed, in the case of the standing position, there was a decrease in PFM voltage during five 2-second phase contractions and an increase in bioelectrical activity during the first 60-second resting measurement. In contrast, when measured in the standing position, the undesired effect after the 8-week therapeutic intervention was an increase in PFM voltage during the second 60-second resting measurement.

The assessment of PFM bioelectrical activity by electromyography is widely regarded as an objective diagnostic method. Moreover, it is used in monitoring therapeutic progress during the rehabilitation of pelvic floor disorders [22]. In addition, the previously cited articles prove the beneficial effect of the therapeutic methods used in the study for women with PFM dysfunction. Thus, the question arises as to why the presented case study did not achieve improvement in all parameters studied. It is challenging to draw far-reaching conclusions based on a single case report. The woman studied did not have a chronic illness, did not use hormonal contraception, and was moderately physically active. A factor that may have influenced the results was the fact that the measurements before and after the therapeutic intervention were not carried out on the same day of the cycle, as this was difficult due to the irregularity of the subject's menstrual cycle. In this case, the statement stating changes in PFM tone (bioelectrical activity) from one day of the cycle to the next seems correct [23]. Referring to the results obtained, it is also worth noting that the available literature lacks studies giving reference values for PFM activity in healthy women. Oleksy et al. [15] attempted to present normative values for all phases and parameters measured by the Glazer protocol based on measurements of 96 healthy, young, nulliparous women from Poland. PFM activity was recorded in the supine position. In the group of female subjects, the mean value obtained during the first 60-second resting measurement was 6.26 μV, and the mean value obtained during the second 60-second resting measurement was 6.93 μV. The minimum value obtained during the first rest was 1.12 μV, and the maximum was 14.50 μV. In the second resting measurement, the minimum value was 1.30 μV, and the maximum value was 17.30 μV.

In the description presented here, the woman in the measurements of PFM bioelectrical activity at rest, despite the voltage increases after therapeutic intervention, obtained results that were far below the average in the study by Oleksy et al. [15] presented above.

Due to its pilot nature, the case study conducted has its limitations. In order to verify the effectiveness of the proposed physiotherapeutic methods in the prevention of urogenital disorders, a much larger group of young, healthy women should be included in the study, guided by strict inclusion and exclusion criteria. Further studies should also be expanded to evaluate the impact of other parameters of endovaginal electrostimulation, including, first and foremost, the frequency used.

Summary

The case report presented here indicates that endovaginal electrostimulation (with the parameters selected for the project purposes) combined with PFM exercises can be an effective tool for improving changes in PFM bioelectrical activity in a young, healthy nulliparous woman with no urogenital dysfunction. However, the desired effect was not obtained in all parameters. Hence, further clinical studies should be conducted to verify the effectiveness of the proposed physiotherapeutic methods in preventing PFM dysfunction, as well as to determine the appropriate parameters of endovaginal electrostimulation protocol.

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