WOMEN'S SEXUAL HEALTH

Electromyographic Evaluation of the Pelvic Muscles Activity After High-Intensity Focused Electromagnetic Procedure and Electrical Stimulation in Women With Pelvic Floor Dysfunction

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ABSTRACT

Introduction: Impaired coordination, relaxation, and atrophy of pelvic floor muscles (PFMs) may cause various health issues referred to as pelvic floor dysfunction (PFD). In recent years, electromagnetic noninvasive stimulation of the pelvic floor was successfully used to treat PFD symptoms.

Aim: This study aims to compare the effectiveness of electrical and magnetic noninvasive stimulation for the treatment of PFD in postpartum women.

Methods: 2 intervention groups treated with high-intensity focused electromagnetic ([HIFEM]; G1) procedure and electrical stimulation (G2) were established along with the control group (G3). Patients received 10 therapies delivered at the hospital (G1; 2−3 times per week) or self-administered at home (G2; every other day) after initial training. The protocol was identical for both modalities. Functionality of the PFM was examined by surface electromyography measurements (maximal voluntary contraction [MVC]; mean MVC; muscle activity at rest; endurance of contraction) while patient's subjective perception of pelvic floor functionality was assessed by Pelvic Floor Impact Questionnaire−Short Form 7 (PFIQ-7) standardized questionnaire. Changes in electromyography values and PFIQ-7 scores were statistically evaluated from baseline to after all treatments.

Main Outcome Measure: The main outcome measure was enhancement of PFM activity.

Results: In total, 95 patients (G1 = 50; G2 = 25; G3 = 20) participated in the study. The MVC, mean MVC, and endurance were lowered in symptomatic patients. After the treatments, these parameters significantly increased ($P < .001$) and moved toward the values of healthy population. Electrogenesis at relaxation revealed divergent tendencies in the G1 and G2 groups. PFIQ-7 scores significantly improved in treated patients ($P < .001$). In general, superior results were documented in the HIFEM group as it reached improvement of electromyography parameters from 48% to 59% (electrical stimulation from 7% to 36%) and similarly the improvement of PFIQ-7 score by 57% (electrical stimulation by 32%).

Conclusion: This study documented that the HIFEM procedure was significantly more effective than electrical stimulation in treatment of PFD in postpartum women. Both the objective and subjective evaluation indicates more profound effects of magnetic stimulation. **Elena S, Dragana Z, Ramina S, et al. Electromyographic Evaluation of the Pelvic Muscles Activity After High-Intensity Focused Electromagnetic Procedure and Electrical Stimulation in Women With Pelvic Floor Dysfunction. Sex Med 2020;8:282−289.**

Key Words: Electrical Stimulation; Electromyography; HIFEM Procedure; Pelvic Floor Dysfunction; Pelvic Floor Muscles

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INTRODUCTION

Electromyography (EMG) is a method frequently used for examination of electrical activity of muscle tissue. Although this technology is relatively new, it is assumed to be reliable and objective, while causing minimal or no discomfort to patients. Essentially, EMG uses the surface or intramuscular electrodes to record the intensity of signals which propagate in the muscle fibers during the contraction because muscle tissue conducts electrical potentials similar to the nerves. Results of the measurements are expressed as a function of voltage over the time. Except single-fiber EMG,[1] measured values represent a sum of all signals originated from the muscle tissue of certain body area.[2–4]

Besides ultrasound,[5,6] magnetic resonance,[7] manometers,[8] dynamometers,[9] or simple palpation combined with observation,[10] surface EMG (sEMG) is one of the possible objective methods for monitoring resting level, strength, and endurance of the pelvic floor muscles (PFMs). The pelvic floor consists of 3 main compartments—anterior (bladder and urethra), middle (vagina and uterus), and posterior (rectum). Furthermore, there are morphologically complex multilayers of anatomical structures such as pelvic diaphragm (composed of levator ani and coccygeus muscles), urogenital diaphragm (composed of connective tissue, perineum, bulbospongiosus, and ischiocavernosus muscles), and urethral/anal sphincters. All of these tissues are arranged in the pelvic area and have multiple attachments to the surrounding structures.[11] Under normal circumstances, the PFM prevents multiple disorders such as incontinence (urinary/fecal), sexual dysfunction, or pelvic organ prolapse accompanied with pain and discomfort. However, the atrophy and relaxation of PFMs may promote manifestation of these heath issues, collectively referred as pelvic floor dysfunction (PFD),[10–12] occurring naturally with aging or as a consequence of childbirth.

Recording of sEMG in women who showed certain symptoms of PFD was reported previously by multiple authors. It has been found that EMG is a suitable method for investigation of PFM functioning among healthy subjects and women with signs of urinary incontinence or PFM weakness.[13–21] Despite the various protocols and electrode configurations used, in general, there is a clear relationship between the characteristics of the EMG signal and PFD. In comparison with the healthy and asymptomatic subjects, postmenopausal and even premenopausal women affected by some form of PFM impairment, show distinctively lower EMG values. The intensity of maximum voluntary contraction (MVC) is reduced because the PFMs are weakened and endurance of contraction and muscle activity during rest are affected as well.[13,14,18–20] Aside from sEMG, various subjective questionnaires (Pelvic Floor Disability Index, Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire, Pelvic Floor Impact Questionnaire, International Consultation on Incontinence Questionnaire - Vaginal Symptoms or Pelvic Floor Bother Questionnaire) were also used to document strengthening and reeducation of the PFM which helped patients to improve their symptoms.[22,23]

Besides the regular exercise,[24] the function of the weakened PFM can be enhanced by noninvasive PFM stimulation. Along with well-established electrical stimulation,[25,26] high-intensity focused electromagnetic (HIFEM) technology is being more frequently used in recent years.[27–29] Both technologies deliver electric currents into the pelvic floor to depolarize membranes of motoneurons to elicit action potential and achieve brain-independent muscle contractions when the action potential of sufficient strength reaches the neuromuscular junction.[30] However, despite the direct flow of electric charge through electrode-tissue surface, the HIFEM induces electrical currents selectively in the PFM by mechanism of electromagnetic induction.[31] As magnetic field passes any medium without attenuation of the energy, the induced contractions may be achieved at greater depths and intensities[32] to possibly provide better outcomes.

Based on the rationale mentioned previously, the aim of this study is to investigate and compare treatment outcomes of the HIFEM procedure and electrical stimulation in women suffering from PFD. The expected changes in PFM activity would be examined by subjective (questionnaire) and objective (sEMG) methods. The measured values will be compared with asymptomatic subjects.

MATERIALS AND METHODS

Patient's Recruitment Criteria

The inclusion criteria were specified as follows: women of age 18–45 years, who had vaginal delivery, and who already stopped lactation. There were 3 patient groups. The symptomatic patients who reported PFD symptoms related to weakened PFM as lower urinary tract or bowel symptoms (incontinence) and/or sexual dysfunction (dyspareunia, vaginal laxity, decreased sensitivity during intimacy, inability to achieve orgasm—anorgasmia), were randomly (2:1) divided into the G1 group treated by HIFEM and G2 group which received electrical stimulation. The third group G3 consisted of healthy postpartum patients, to obtain sEMG values of normal population. Exclusion criteria were presence of any metal implants or devices which include metal components, pregnancy, malignant tumor, history of surgical procedure in the pelvic region, presence of pelvic organ prolapse of stage II-IV as per the Pelvic Organ Prolapse Quantification classification, and all general contraindications for physiotherapy. Patients were asked to perform pregnancy test before the first treatment and then retest on a regular basis.

Ethical Considerations

This study was approved by the local ethics committee of Hospital Lapino (MD medical group). It complied with ethical principles stated in the Declaration of Helsinki, Convention on Human Rights and Biomedicine, and International Ethical Guidelines for Health-related Research Involving Humans, and it completely excludes impairment of patients' interests and damage to health. All of the subjects were informed about the potential risks and possible benefits of the study, and all participants provided written informed consent.

Treatment Protocol

Both intervention groups received 10 treatments in total addressing the stimulation of PFM. The G1 group was treated using a BTL EMSELLA (BTL Industries Inc, Boston, MA) device, which uses HIFEM technology for noninvasive PFM stimulation and reeducation based on the principle of electromagnetic induction. The device consists of a generator connected to the chair where the stimulation coil is located. The coil emits focused magnetic field of intensities up to 2.5 Tesla, responsible for induction of muscle contraction up to depths of 10 cm. Each therapy with the BTL EMSELLA device lasted 28 minutes, and it was administered under the supervision of a skilled physician at the Lapino Hospital. Patients were seated in a chair, and the intensity of the stimulus was modulated on the scale of 0−100% (0−2.5 Tesla) in accordance with their feedback up to maximum tolerable threshold, when patients felt a strong muscle contraction but without pain or discomfort. All patients have achieved 100% intensity during the first or second procedure. Treatments with HIFEM were addressed 2−3 times per week for a duration of 4 weeks. The sessions were planned to suffice this interval as per the patient/device availability. 2 consecutive treatments were spaced at least 48 hours apart to prevent muscle fatigue.

The G2 group performed home-based and self-administered procedures with a BioBravo (MTR+ Vertriebs, GMBH, Germany) electrical stimulation device. First, the patients were comprehensively trained how to safely and effectively use a BioBravo stimulator. Then, they were instructed to finish treatments at home by repeating therapy every other day. The protocol of stimulation was identical for both groups because the settings of the BioBravo device have been adjusted to reflect those used by the BTL EMSELLA device. Finally, group G3 did not receive any treatment.

sEMG Measurements

The primary outcome of the study was to perform sEMG measurements to determine activation of the PFM in symptomatic and asymptomatic patients and to document the hypothesized changes caused by muscle strengthening. At first, by using a Myomed 632 myofeedback device (Enraf-Nonius B.V., Netherlands), the patients were instructed how to correctly perform contractions of the PFM without (voluntary) involving the muscles of the anterior abdominal wall and gluteal or hip region. When performing contractions, patients were lying in the supine position. During the examination, they were requested to repeat 3 specified PFM activations which consisted of the following: 5 short (quick flick) contractions at maximum intensity with an interval of 10 seconds, followed by sustained contraction and relaxation (both 10 seconds long, 5 repetitions) and finally the sustained contraction held as long as possible to determine PFM endurance.[33]

The sEMG recordings were performed by the Myomed 632 device at the baseline (all groups) and after the patient's last treatment (only G1 and G2). To isolate the signal originated in the PFM, 2 types of superficial electrodes were used: first was applied on the anterior abdominal area (served as reference), and the second (vaginal) electrode was mounted on the intravaginal probe. Neutral gel was always applied on the sensor introduced into the vagina. An experienced physiotherapist confirmed the correct placement of intravaginal probe and PFM contractions. Concurrent registration of muscular electric potential by using the vaginal and skin electrodes allowed differentiating PFM contractions. During the sEMG examination, myofeedback (in a form of graph) was displayed on the device's monitor and the external monitor unit which was additionally connected to the device to enlarge the graphic output. The sEMG measurements were performed automatically by the Myomed device, following the pattern of PFM activations described higher. These parameters were acquired for each patient during each visit: MVC, mean MVC, mean activity at rest/resting level (all in μV), and endurance of contraction (in seconds).

Standardized Questionnaire

The secondary outcome was to assess subjective changes in perception of PFD by the PFIQ-7. This standardized questionnaire was used to determine the impact of PFD on the patient's quality of life as it showed to be psychometrically valid and reliable in previous research.[34] Patients from groups G1 and G2 were given the PFIQ-7 at baseline and after the last treatment. Based on their answers, the PFIQ mean scores (on a scale from 0 = no distress to 300 = maximal distress) were calculated and compared against baseline and between the both groups.

Safety

The safety of treatments and sEMG measurements and possible adverse events (AEs) were monitored. Patients were also asked to report any signs of discomfort or pain during the therapies or caused by the positioning of the intravaginal electrode.

Statistical Analysis

All variables were checked for normality by the Kolmogorov-Smirnov test. Descriptive statistics were estimated by the sample mean with 95% confidence interval. The differences between groups were tested using analysis of variance test followed by Least Significant Difference post hoc tests. Levene's test of homogeneity of variance was run before analysis of variance to verify the equal variances in groups. Paired variables were tested by a student's t-test. All statistical tests were 2-tailed. Whole statistical analysis was conducted with Statistica v.6 (StatSoft Inc, Tulsa, OK), and the significance level was set as default to 0.05 (5%). Initially, the minimum sample size was verified by using Statistica software. At least 19 subjects must have been included in each of the 3 tested groups, to achieve a power of 80% with $\alpha = 5\%$.

RESULTS

Patient Group Characteristics

In total, 95 patients were recruited during 2018 and early 2019 in accordance with the specified criteria and current state of

Table 1. Characteristics of patient groups at the time of recruitment (mean followed by 95% confidence interval)

Group	Age (years)	BMI ($kg \cdot m^{-2}$)	Vaginal deliveries	PFD symptoms (% of patients)
G1 (n = 50)	31.12 (1.52)	23.27 (0.76)	1.76 (0.22)	Urinary incontinence (74%); decreased sexual desire (36%); decreased sensitivity during intimacy (70%); dyspareunia (26%); hypo/anorgasmia (52%)
G2 (n = 25)	31.96 (3.20)	24.32 (3.70)	1.56 (0.27)	Urinary incontinence (72%); decreased sexual desire (44%); decreased sensitivity during intimacy (44%); dyspareunia (24%); hypo/anorgasmia (40%)
G3 (n = 20)	27.20 (2.02)	22.40 (1.27)	1.25 (0.21)	-

BMI = body mass index; PFD = pelvic floor dysfunction.

patients in the clinic: G1 (n = 50), G2 (n = 25), and G3 (n = 20). See Table 1 for detailed characteristics of patient groups. All of the recruited patients from the G1 and G2 groups finished a prescribed number of treatment sessions. 8 patients who reported zero PFIQ-7 score at the baseline (G1 = 5, G2 = 3) were excluded from the questionnaire evaluation. No AEs were observed in regard to the delivered treatments or sEMG measurements. Subjects seldom reported only mild discomfort when recording sEMG using an intravaginal electrode.

Quantification of the EMG Signal

The results of sEMG measurements are summarized in Table 2. In general, there are significant differences between the symptomatic groups in comparison with healthy patients. On the other hand, the changes in the measured values after the HIFEM or electrical stimulation were highly statistically significant ($P < .001$) in comparison with the baseline, showing that stimulation of the PFM modifies the muscle (electrical) activity.

At baseline, measured peak intensity of the MVC signal was significantly higher in healthy patients by approximately 22 μV on average, when compared with that in the G1 or G2 group. At the same time, there was no change between the intervention groups. At the end of study, the G1 group showed significantly higher EMG values than the G2 group ($P < .001$), reaching an average change of 10.58 μV (57.29%) and 1.44 μV (7.34%), respectively. Although the HIFEM treatment considerably increased the PFM activity, the G1 group still showed lower values than control.

Similar findings were observed in case of average MVC. As expected, the average MVC magnitudes are lower in each group. The more profound increment was also observed in the G1 group (6.65 μV, 58.69%) compared with the modest increase of the G2 group (0.91 μV, 6.81%). There were also significant differences between G1 and G2 groups after treatments ($P < .05$). Despite the observed improvement, asymptomatic subjects still showed greater EMG values.

Interestingly, the examination of muscle activity at rest revealed divergent tendencies. Initially, only the G1 group showed significantly different (higher) values from control ($P < .05$) while after the last therapy, the G1 average resting level decreased at the level of G3 (2.08 μV and 1.90 μV, respectively). Conversely, the average resting level of the G2 group had risen from 2.42 μV to 3.94 μV. In conclusion, the G2 subjects manifested significantly higher EMG values than the control and G1 group at the end of study ($P < .001$).

In terms of endurance, there were observed significant differences between both the symptomatic groups and either control group at the baseline and after the treatments (see Table 2). The measurement of the G3 group showed that healthy patients were able to hold contraction of the PFM on average for 62.25 s. Furthermore, we observed a significant increase in endurance of PFM contraction by 48.24% in the G1 group because the patients have been able to hold a contraction by 13.44 s longer after their treatments, reaching 41.30 s in total. The G2 group improved by 36.26%, and PFM contraction was prolonged on average by 6.60 s.

Pelvic Floor Impact Questionnaire—Short Form 7

Patient's subjective evaluation is summarized in Table 3 and Figure 1. The minimal variation in the baseline score of both symptomatic groups was insignificant. Nonetheless, after the last treatment, there was an observed significant difference in the PFIQ score between the G1 and G2 group ($P = .01$). Although both treatment modalities resulted in highly significant subjective improvement, the patients treated with HIFEM experienced greater outcomes. In addition, 16 patients (35.56%) from the G1 group reached a score of zero after the HIFEM treatments (meaning 100% improvement against the baseline). Contrary to this, only 3 patients (12.00%) from the G2 group, who underwent electrical stimulation, reported zero score at their last visit.

The shift in PFIQ scores is visualized in Figure 1. As can be seen, the relative frequency of scores was remarkably changed in the G1 group while almost 90% of patients fall into the low-score categories (0—10 or 10—20) after the treatments. In addition, the scores more than 50 were entirely eliminated from patient's responses. The G2 group showed only minimal changes in distribution of patient's PFIQ scores, corresponding to a moderate average improvement of 5.15 points (see Table 3).

DISCUSSION

Our examination of PFM electrogenesis in patients, who showed signs of PFD, revealed a significant reduction of the

Table 2. Results of the sEMG measurements at the baseline and after the last therapy for both treated groups (G1 and G2) and control subjects (G3) presented as mean followed by 95% confidence interval in brackets

Group	Peak MVC (μV)		Average MVC (μV)		Resting level (μV)		Endurance (s)	
	Baseline	After	Baseline	After	Baseline	After	Baseline	After
G1 (n = 50)	19.49† (2.31)	30.06†,*** (3.75)	11.33† (1.54)	17.99†,* (2.50)	3.83†,* (0.82)	2.08 (0.38)	27.86†,** (4.17)	41.30†,*** (5.21)
G2 (n = 25)	19.56† (2.93)	21.00† (2.82)	13.39† (2.46)	14.30† (2.42)	2.42 (0.45)	3.94†,*** (0.60)	18.20† (2.85)	24.80† (3.12)
G3 (n = 20)	41.96 (2.51)	-	32.69 (1.88)	-	1.90 (0.63)	-	62.25 (3.68)	-

EMG = electromyography; MVC = maximal voluntary contraction; sEMG = surface electromyography.
Significantly different results ($P \leq .002$) against control are depicted by† and * denotes significantly higher EMG values for comparison of G1 and G2.
*$P < .05$, **$P < .01$, ***$P < .001$.

generated EMG signal in comparison with the asymptomatic patients at baseline (MVC, mean MVC, and endurance). The results of intervention groups G1 and G2 denote that noninvasive PFM strengthening is able to positively influence the activity of the PFM. As seen in Table 2, the sEMG measurements obtained after therapies with the BTL EMSELLA device or electrical stimulation showed increased values of maximum possible voluntary contraction and endurance. It suggested that at the end of study, patients were capable of stronger and more complex PFM contractions resulting in reduction of PFD symptoms (whether incontinence or sexual based), demonstrated also by significant decrease in the PFIQ-7 score.

In contrast to sEMG measurements, which demonstrated considerable PFM weakening in the G1 and G2 group at baseline, the PFIQ resulted in relatively low scores in both groups. We attribute this to perhaps a less specific grading system of the PFIQ, when evaluating patients who showed a various range of PFD-related symptoms of different severity. In future studies, it might be beneficial to focus on the evaluation of particular patient's symptoms by using condition-specific questions evaluated by a visual analogue scale or 5- to 7-point Likert scale for instance to enhance grading possibilities.

Comparison of the Magnetic and Electrical Stimulation

Significantly, greater improvement in EMG values was observed in the G1 group, treated by HIFEM technology. In comparison with electrical stimulation, the BTL EMSELLA device showed to be substantially more effective in restoration of muscle strength as the MVC, mean MVC, and endurance parameters uniformly increased ranging from 48 to 59% after HIFEM treatments. On contrary, electrical stimulation induced only mild changes in MVC (7.34%) or mean MVC (6.81%) while reaching mild to moderate improvement (36.26%) of endurance.

The sEMG measurements coincide with the results of the PFIQ. Patient's subjective evaluation showed more pronounced improvement in the G1 group (57.16%) than in the G2 group (32.18%), which corresponds to the improvement rate in EMG values. The HIFEM procedure also resulted in substantial reduction of high PFIQ scores after the last therapy session (see Figure 1).

PFM Electrical Activity and sEMG Measurements

Given the specific patient group and scarce evidence in literature, control group G3 was established to obtain normative EMG values, valid for the studied sample. In general, herein presented results coincide with the previously published findings. It has been documented by numerous authors[13–15,17,18,20] that women who are suffering from PFD show lower MVC and endurance values because of the impairment of the PFM. By the proper stimulation of the PFM, patients are able to produce

Table 3. Results of the PFIQ-7 for the both treated groups (G1 and G2) presented as mean followed by 95% confidence interval in brackets

	PFIQ-7 average score		Improvement		
Group	Baseline	After	Absolute	Relative	*P*-value
G1 (n = 45)	24.68 (6.81)	9.67 (3.38)	15.01	57.16%	<.001
G2 (n = 22)	26.04 (8.69)	20.89 (8.04)	5.15	32.18%	<.001
P-value	.81	.01	-	-	-

Absolute and relative differences against baseline were calculated.

greater voluntary contractions for longer durations. In addition, the muscle activity at rest is influenced by the PFD as the PFMs are less electrically active. However, the evaluation of the PFM resting level revealed significant differences between both modalities in our study. Although the G1 group after treatments reached similar EMG values as healthy population, patients from group G2 showed altered muscle activation with relatively high electromyogenesis at rest (3.94 μV on average, see Table 2). This indicates that G2 patients cannot properly relax their PFM after treatments because they are not able to isolate and control the appropriate muscle activation patterns, which was then reflected by the lower MVC amplitudes. The correct activation pattern during PFM contraction is associated with increased activation of the PFM and lower transverse abdominal wall with markedly less activation of the upper abdominal and chest wall. The inappropriate activation refers to an increased level of abdominal and chest wall activation while PFM activation decrease,[16] resulting in lessened strength (MVC amplitude) of contraction.

Showing high test-retest reliability,[13,14] the sEMG measurement is a useful tool for detection of PFM activity. For recording of PFM electrical activity, we used an intravaginal electrode with a large surface to obtain EMG signals of sufficient amplitude with high sensitivity.[2,3] Fortunately, the PFM encompasses only a partial amount of subcutaneous tissue which may possibly further attenuate the amplitude of EMG.[35] To prevent any systematic error during measurements, insertion and the position of the measuring electrode was supervised by the skilled physiotherapist. The normalization of data was not considered necessary as we assessed the same muscle group during one measurement session without removal of the active electrode.[3] The selectivity of measured values

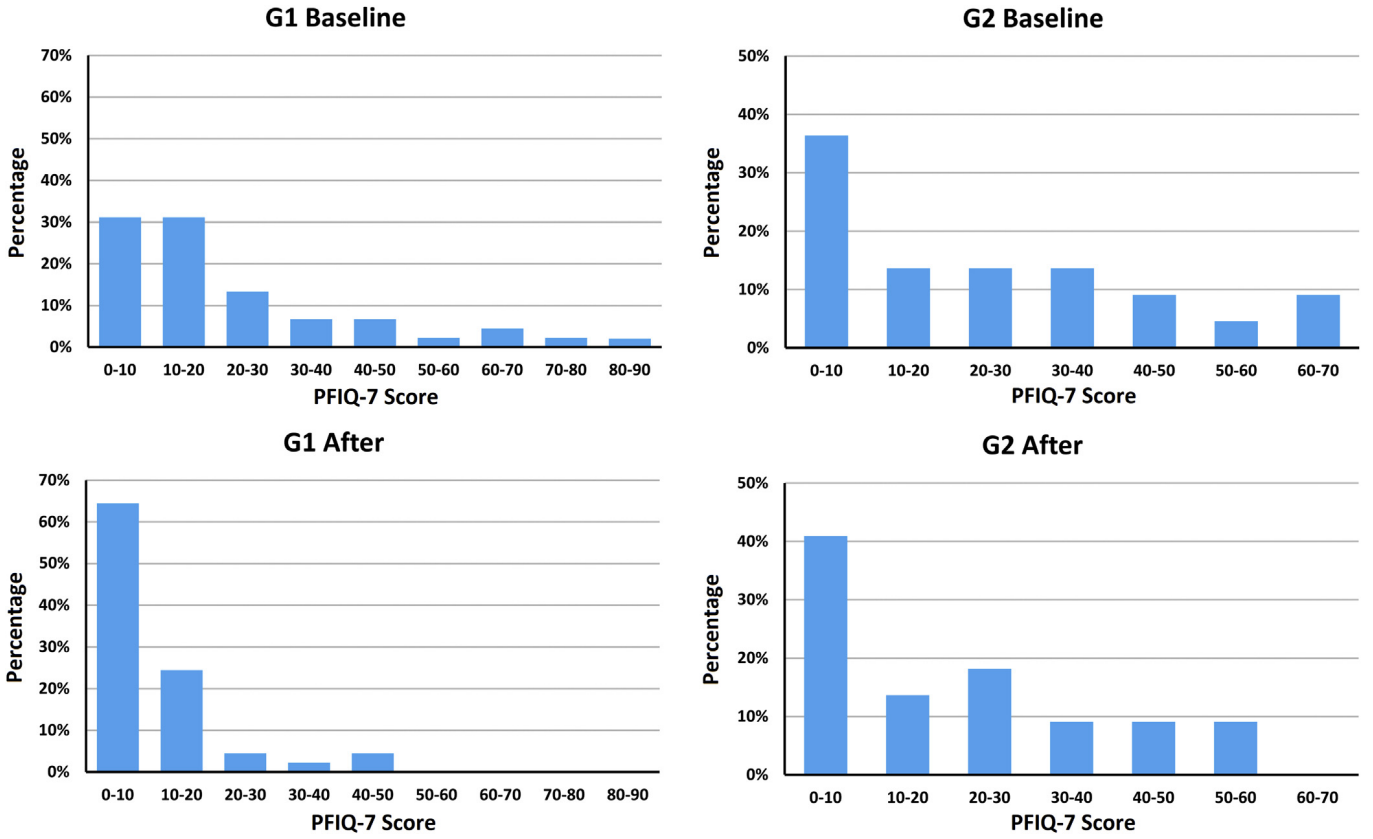

Figure 1. The comparison of PFIQ-7 scores per group and appointment. The relative frequencies of scores reported by the patients of group 1 (G1) and group 2 (G2) are plotted in the graphs. There is a substantial shift toward the lower PFIQ-7 scores in the G1 group after the treatments.

was accomplished by the reference electrode, placed on the abdomen. The signal obtained by the abdominal electrode was subtracted from the recording site to eliminate common components, and received EMG values thus represented summation activity of the whole PFM. To achieve an even greater degree of selectivity, the specific design of the vaginal electrode is required. For instance, Voorham-van et al[14] have been able to successfully measure and compare the activity of selected pelvic muscles (pubococcygeus, puborectalis, bulbospongiosus and ischiocavernosus) by using experimental intravaginal probe with a matrix of 24 electrodes.

Study Limitations

Still, a sEMG measurement faces various challenges. The nature of the recorded electrical signal (amplitude, frequency or noise) is influenced by several factors, such as composition of measured muscle along with structure and position, or placement of electrodes.[35] The core and skin temperature[36] or different humidity of measured environments may also influence the signal parameters. Because of the moisture and temperature within the vaginal lumen, it is difficult to ensure identical conditions at each visit during the intravaginal measurements. Especially, the moisture between the electrode and tissue may lead to decreased EMG amplitude. Furthermore, the electrode positioning is crucial for reliability of sEMG measurement. Therefore, the operator must insert the intravaginal probe consistently with respect to the measured muscles as the power of the signal is affected by the electrode orientation.[37] In addition, the intravaginal probes should be designed in such a way to minimize any impact on the PFM by its insertion to avoid cross talk and motion artifacts.[14]

Indisputably, the appropriate planning of treatments is essential to achieve desired results. Unlike the electrical stimulation, HIFEM is relatively new technology which is still being investigated to some extent. In our study, the HIFEM treatments were administered at least 48 hours apart (2−3 per week) to maximize treatment outcomes but also to avoid muscle fatigue, caused by overtreatment of the PFM, as the therapy with maximum settings produces intense muscle contractions. Presumably, the results would differ because of changes of the treatment frequency; however, this should be verified by future studies.

CONCLUSION

Electromyographic measurement of PFM activity proved to be a valid method for examination of patients with PFD (suffering from urinary incontinence and/or accompanied with sexual dysfunction) treated with HIFEM and electrical stimulation. Surface EMG of the PFMs showed more profound muscle activation after HIFEM treatments along with improved relaxation and enhanced endurance. As well, the PFIQ indicates greater effect of HIFEM procedure based on the significant change of score reported by patients. Documented outcomes imply that the HIFEM procedure is substantially more effective in restoration of PFM strength and treatment of PFD when compared with the electrical stimulation, applied correspondingly in postpartum women.

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