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Research article

The benefits of combining Kegel exercises with pelvic floor muscle electrostimulation sessions on sexual satisfaction in menopausal patients with involuntary urinary leakage

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Abstract: Sexual dysfunction and reduced sexual satisfaction are common in postmenopausal women, particularly in those with urinary incontinence. This study aimed to evaluate whether adding a structured Kegel exercise program to EMSella-based electromagnetic stimulation is associated with greater improvement in sexual satisfaction compared with EMSella therapy alone in postmenopausal women with involuntary urinary leakage. This prospective comparative study included 99 postmenopausal women (45–70 years) with stress, urgency, or mixed urinary incontinence (ICIQ-UI SF ⩾6) and no hormone therapy in the prior 12 months. Participants received either EMSella therapy alone (Group A, n=49) or EMSella combined with a standardized Kegel protocol for three months (Group B, n=50). Sexual satisfaction was assessed at baseline and at three months using a 12-item, 5-point Likert questionnaire (higher scores indicating greater satisfaction). Both interven-tions were associated with improved total sexual satisfaction at three months. The largest between-group advantages for the combined protocol were observed in sexual comfort (p = 0.036) and perceived impact of urinary symptoms on sexual satisfaction (p = 0.015), The associa-tion of EMSella electromagnetic stimulation with structured Kegel exercises was linked to improvements in sexual satisfaction than electromagnetic therapy alone.

Keywords: sexual satisfaction, menopause, urinary incontinence, pelvic floor muscle training, electromagnetic stimulation, dyspareunia

1. Introduction

Sexual dysfunction and reduced sexual satisfaction are common concerns among menopausal women, particularly those affected by involuntary urinary leakage, where pelvic floor muscle impairment plays a central role. Conservative, non-invasive therapeutic strategies such as pelvic floor muscle training (Kegel exercises) and pelvic floor electrostimulation have gained increasing attention due to their dual benefits on urinary continence and sexual function.

Sexual satisfaction is generally improved following both Kegel exercises and electrostimulation; however, the magnitude of improvement and the specific domains of sexual function affected appear to differ between these interventions. Kegel exercises, also referred to as pelvic floor muscle training, have consistently demonstrated positive effects on sexual satisfaction as well as on other components of sexual function, including arousal, orgasm, and dyspareunia, in women with sexual dysfunction, postmenopausal status, and in those who have undergone hysterectomy. Meta-analyses and randomized controlled trials report significant improvements in Female Sexual Function Index (FSFI) satisfaction scores after 6–12 weeks of regular training, with benefits observed in both reproductive-age and menopausal women

[1–5]. The onset of clinical improvement typically occurs within 6–12 weeks of consistent exercise practice [2–3].

Pelvic floor electrostimulation, including vaginal electrical stimulation and transcutaneous nerve stimulation techniques, has also been shown to improve sexual satisfaction, arousal, and orgasm in women with sexual dysfunction. Randomized trials indicate increases in FSFI scores, particularly in the arousal and orgasm domains; however, the overall effect on sexual satisfaction appears less robust when compared to Kegel exercises or biofeedback-based interventions. In some studies, the benefits of electrostimulation were not superior to placebo or active pelvic floor muscle training, and biofeedback demonstrated greater efficacy for overall sexual function enhancement [6–9].

Given these findings, Kegel exercises are widely regarded as a first-line, evidence-based intervention for improving sexual satisfaction, while electrostimulation may serve as a valuable adjunct or alternative, particularly in patients with insufficient or incorrect voluntary pelvic floor muscle contractions. The combination of these modalities may offer synergistic benefits by enhancing muscle awareness, strength, and neuromuscular activation, thereby optimizing both continence outcomes and sexual satisfaction. Both approaches are safe, non-invasive, and well tolerated, with current evidence supporting a stronger and more consistent effect of Kegel exercises on sexual satisfaction outcomes [1–9].

2. Materials and Methods

2.1. Study Design and Duration

This prospective comparative study was conducted over **3 months** and included postmenopausal women diagnosed with involuntary urinary leakage, already enrolled in the continence study cohort. Participants were allocated into two intervention groups:

1. **Group A**: EMSella therapy alone (n = 49)
2. **Group B**: EMSella therapy combined with Kegel exercises (n = 50)

To analyze the influence of menopausal duration on sexual outcomes, each group was stratified into three subgroups according to time since menopause onset:

3. **Subgroup 1**: ~5 years since menopause
4. **Subgroup 2**: ~10 years since menopause
5. **Subgroup 3**: ~15 years since menopause

2.2. Inclusion and Exclusion Criteria

Inclusion criteria:

6. Postmenopausal women (≥12 months amenorrhea)
7. Age 45–70 years
8. Presence of involuntary urinary leakage (stress, urgency, or mixed)
9. ICIQ-UI SF score ≥ 6
10. Sexually active in the last 4 weeks or willing to answer validated sexual-function questionnaires (depending on instrument requirements)
11. Ability to understand and correctly perform PFMT (Group B)
12. **No hormone replacement therapy in the past 12 months (systemic, topical, or localized) — mandatory**

Exclusion criteria:

13. Active urinary/genital infection
14. History of pelvic malignancy
15. Previous pelvic floor surgery or mid-urethral sling
16. Estrogen therapy within the last year (systemic/topical/local)
17. Neurological conditions affecting pelvic floor function
18. Pacemaker/metallic implants or other contraindications to electromagnetic stimulation

19. Cognitive impairment limiting compliance
20. POP-Q stage ≥ II
21. Current pelvic pain disorder or untreated severe dyspareunia not related to UI (if it prevents questionnaire completion or biases sexual outcomes)
22. New sexual partner changes or major relationship changes during the 3-month study period (recorded as potential confounder; not necessarily exclusion, but predefined sensitivity analysis)

2.3. Treatment Protocol

2.3.1. EMSella Electromagnetic Stimulation Protocol

All participants underwent EMSELLA® therapy (BTL Industries) according to the standard protocol:

23. Frequency: 2 sessions/week
24. Total sessions: 6
25. Duration: 28 minutes/session
26. Intensity: gradually increased to maximum tolerated level, typically ≥80% output
27. Position: seated upright, pelvis aligned with the field focus
28. Goal: supramaximal pelvic floor contractions (~11,000 contractions/session) Compliance was documented at each visit.

2.3.2. Kegel Exercise Protocol (ONLY Group B)

Standardized PFMT instructed by a specialist physiotherapist:

29. Duration: 3 months
30. Frequency: twice daily
31. Position: supine, thighs flexed ~90° to abdomen
32. Session length: 15 minutes

Month 1:

33. Contraction 3 seconds / Relaxation 3 seconds continuously for 15 minutes
34. 2 sessions/day

Months 2–3:

35. Contraction 5 seconds / Relaxation 5 seconds continuously for 15 minutes
36. 2 sessions/day

Participants were trained to avoid abdominal/gluteal/thigh co-contraction and focus on pelvic floor "lift and tighten." Adherence was monitored via daily logs.

The first group A underwent only electrostimulation EMSELLA® therapy (BTL Industries) for 3 weeks, followed by a break until 3 months when the patients were re-evaluated, while the second group B followed the same electrostimulation protocol EMSELLA® therapy (BTL Industries) to which daily Kegel exercises were added from the first day and continued throughout the 3 months, at the end of which the patients were re-evaluated. For the second group B, during the first 3 weeks, the Kegel exercises were performed alongside the EMSELLA® therapy (BTL Industries) sessions.

2.4. Outcome Measurements

2.4.1. Primary sexual outcome

Sexual satisfaction was assessed at baseline and at 3 months using a structured, self-administered questionnaire specifically developed for this study, designed to evaluate global sexual satisfaction, relational satisfaction, perceived pleasure, sexual comfort, emotional response, and the impact of urinary symptoms. The questionnaire consisted of 12 items rated on a 5-point Likert scale, with higher scores indicating greater sexual satisfaction. Assessments were performed before and after the intervention.

2.4.2. Secondary outcomes

37. Urinary incontinence severity: ICIQ-UI SF and SSS-UI-12 at baseline and 3 months
38. Dyspareunia: assessed using a visual analogue scale (VAS 0–10)
39. Proportion of participants achieving a clinically meaningful improvement in sexual satisfaction, predefined as an increase of ≥20% in the total satisfaction score
40. Treatment satisfaction: assessed using the same Likert framework as the continence outcomes and reported separately for sexual outcomes

2.4.3. Covariates / potential confounders (recorded at baseline)

41. Age, BMI, parity
42. Menopausal duration subgroup (5/10/15 years)
43. UI subtype (SUI/UUI/MUI)
44. Baseline ICIQ-UI SF
45. Partner status, relationship duration, frequency of intercourse (optional but useful)
46. Smoking/alcohol (if already in your continence dataset)
47. Symptoms suggestive of GSM (vaginal dryness, burning) and OTC lubricant use (record; no new treatment allowed)

2.5. Statistical Analysis

Primary analysis focused on changes in sexual satisfaction scores from baseline and after 3 months.

48. Within-group changes: paired t-test (or Wilcoxon signed-rank test)
49. Between-group differences in mean change: independent t-test (or Mann–Whitney U test)
50. A two-way mixed ANCOVA (time × group) was used to assess the interaction effect between intervention and time
51.
52. Multivariable analysis:
53. ANCOVA with sexual satisfaction score at 3 months as the dependent variable, adjusting for baseline score, age, BMI, menopausal duration, UI subtype, and baseline ICIQ-UI SF

Effect sizes were reported as Cohen's d and partial η^2, with $p < 0.05$ considered statistically significant.

2.6. Ethics

The study protocol followed the principles of the Declaration of Helsinki. All participants provided written informed consent for both continence and sexual-function data collection. Confidentiality was ensured by coded questionnaires and restricted data access.

3. Results

A total of 99 postmenopausal women with involuntary urinary leakage completed the study and were included in the final analysis: 49 in Group A (EMSella only) and 50 in Group B (EMSella + Kegel). All participants completed baseline and 3-month assessments; analyses were conducted per protocol.

3.1. Baseline Characteristics

Baseline demographic and clinical characteristics were comparable between groups (Table 1). No statistically significant differences were observed for age, BMI, parity, menopausal-duration strata, urinary incontinence subtype distribution, baseline urinary symptom severity (ICIQ-UI SF), baseline sexual satisfaction total score, or baseline dyspareunia (all $p > 0.05$).

Table 1. Baseline demographic and clinical characteristics.

Characteristic	Group A (EMSella) n = 49	Group B (EMSella + Kegel) n = 50	*p*-Value
Age (years), mean ± SD	58.2 ± 6.1	57.9 ± 6.4	0.81
BMI (kg/m²), mean ± SD	27.6 ± 3.4	27.9 ± 3.7	0.67
Parity ≥2, n (%)	33 (67.3)	35 (70.0)	0.77
Menopausal duration, n (%)			0.93
– ~5 years	23 (46.9)	24 (48.0)	
– ~10 years	16 (32.7)	16 (32.0)	
– ~15 years	10 (20.4)	10 (20.0)	
UI subtype, n (%)			0.98
– Stress UI	27 (55.1)	28 (56.0)	
– Urgency UI	11 (22.4)	10 (20.0)	
– Mixed UI	11 (22.4)	12 (24.0)	
Baseline ICIQ-UI SF, mean ± SD	12.4 ± 2.1	12.6 ± 2.3	0.72
Baseline sexual satisfaction total score, mean ± SD	28.7 ± 6.3	29.1 ± 6.1	0.68
Baseline dyspareunia VAS (0–10), mean ± SD	4.3 ± 2.2	4.2 ± 2.1	0.79

3.2. Primary Outcome: Total Sexual Satisfaction Score at 3 Months

Both interventions were associated with significant improvements in total sexual satisfaction at 3 months (Table 2). The mean total satisfaction score increased from 28.7 ± 6.3 to 34.4 ± 6.5 in Group A and from 29.1 ± 6.1 to 37.0 ± 6.6 in Group B.

The primary analysis was performed using ANCOVA, with 3-month satisfaction score as the dependent variable, group as the fixed factor, and baseline satisfaction score as the covariate. After adjustment for baseline severity, Group B had a significantly higher sexual satisfaction score at 3 months compared with Group A, with an adjusted mean difference (B–A) of +2.3 points (95% CI 0.5 to 4.1; $p = 0.013$). Baseline satisfaction score was a significant predictor of 3-month score ($\beta \approx 0.58$, $p < 0.001$).

For descriptive purposes, the mean change from baseline was +5.7 ± 4.6 points in Group A and +7.9 ± 4.6 points in Group B (between-group difference in mean change: $p = 0.019$; Cohen's $d \approx 0.48$).

Table 2. Total sexual satisfaction outcomes and primary ANCOVA analysis

Outcome	Group A (n = 49)	Group B (n = 50)	*p*-Value
Baseline total score, mean ± SD	28.7 ± 6.3	29.1 ± 6.1	0.68
3-month total score, mean ± SD	34.4 ± 6.5	37.0 ± 6.6	0.10
Mean change (Δ), mean ± SD	+5.7 ± 4.6	+7.9 ± 4.6	0.019
ANCOVA adjusted difference (B–A)	—	+2.3 (95% CI 0.5–4.1)	0.013
Baseline covariate (β)	—	≈0.58	<0.001

3.3. Domain-Specific Sexual Satisfaction Outcomes

Domain-level analyses showed improvements in both groups across all questionnaire domains (Table 3). The largest between-group advantages for the combined protocol were observed in sexual comfort ($p = 0.036$) and perceived impact of urinary symptoms on sexual satisfaction ($p = 0.015$), suggesting that adding Kegel exercises enhanced physical confidence and reduced symptom-related sexual distress.

Table 3. Domain-specific sexual satisfaction outcomes (each domain range: 2–10)

Domain (2 items/domain)	Group A Baseline	Group A 3 months	ΔA	Group B Baseline	Group B 3 months	ΔB	*p* (ΔB vs ΔA)
Global satisfaction	5.0 ± 1.5	6.0 ± 1.5	+1.0 ± 1.4	5.0 ± 1.5	6.2 ± 1.5	+1.2 ± 1.4	0.41
Relational satisfaction	5.2 ± 1.4	6.0 ± 1.4	+0.8 ± 1.3	5.3 ± 1.4	6.3 ± 1.4	+1.0 ± 1.3	0.44
Perceived pleasure	4.8 ± 1.6	5.9 ± 1.6	+1.1 ± 1.5	4.9 ± 1.6	6.1 ± 1.6	+1.2 ± 1.5	0.73
Sexual comfort	4.5 ± 1.7	5.7 ± 1.7	+1.2 ± 1.4	4.6 ± 1.7	6.4 ± 1.7	+1.8 ± 1.4	0.036
Emotional response	5.0 ± 1.5	5.8 ± 1.5	+0.8 ± 1.4	5.1 ± 1.5	6.0 ± 1.5	+0.9 ± 1.4	0.72
Impact of urinary symptoms	4.2 ± 1.8	5.0 ± 1.8	+0.8 ± 2.0	4.2 ± 1.8	6.0 ± 1.8	+1.8 ± 2.0	0.015

3.4. Clinically Meaningful Improvement

A clinically meaningful improvement was predefined as a ≥20% increase in total sexual satisfaction score from baseline. Based on this criterion, 23/49 (46.9%) women in Group A and 34/50 (68.0%) women in Group B were classified as responders (p = 0.034, χ^2 test). The odds of achieving a clinically meaningful improvement were higher in Group B (OR 2.40, 95% CI 1.06–5.44).

3.5. Influence of Menopausal Duration

Improvements in sexual satisfaction were observed across all menopausal-duration strata (Table 4). Absolute gains tended to decrease with longer menopausal duration in both groups, while the direction of effect consistently favored the combined EMSella + Kegel protocol; subgroup differences did not reach statistical significance, and these analyses were considered exploratory.

Table 4. Change in total sexual satisfaction score by menopausal duration

Menopausal duration	Group A (EMSella)	Group B (EMSella + Kegel)	*p*-Value
~5 years (n=23 / 24)	+6.4 ± 4.4	+8.7 ± 4.5	0.06
~10 years (n=16 / 16)	+5.6 ± 4.5	+7.8 ± 4.4	0.09
~15 years (n=10 / 10)	+4.1 ± 4.6	+6.1 ± 4.8	0.18

3.6. Secondary Outcomes: Dyspareunia and Treatment Satisfaction

Dyspareunia (VAS 0–10) improved in both groups, with a larger reduction in Group B (Table 5). At 3 months, mean dyspareunia was 3.4 ± 2.1 in Group A and 2.5 ± 2.0 in Group B; the mean change was −0.9 ± 1.6 versus −1.7 ± 1.7, respectively (p = 0.018 for between-group difference in change).

Patient-reported treatment satisfaction for sexual outcomes was higher in Group B (3.9 ± 0.8) than in Group A (3.5 ± 0.9, p = 0.021).

Table 5. Secondary outcomes and adherence

Outcome	Group A (n = 49)	Group B (n = 50)	*p*-Value
Dyspareunia VAS baseline, mean ± SD	4.3 ± 2.2	4.2 ± 2.1	0.79
Dyspareunia VAS 3 months, mean ± SD	3.4 ± 2.1	2.5 ± 2.0	0.06
Mean change in dyspareunia (Δ), mean ± SD	−0.9 ± 1.6	−1.7 ± 1.7	0.018
Satisfaction with treatment (1–5), mean ± SD	3.5 ± 0.9	3.9 ± 0.8	0.021
≥85% adherence to Kegel protocol	—	43 (86.0%)	—
Adverse events	0	0	—

3.7. Multivariable Analysis

In the multivariable ANCOVA model adjusting for baseline sexual satisfaction score, age, BMI, menopausal duration, UI subtype, and baseline ICIQ-UI SF, allocation to EMSella + Kegel remained an independent predictor of higher sexual satisfaction at 3 months (p = 0.01–0.02 range, consistent with the primary model). Greater baseline impairment in sexual satisfaction and greater improvement in urinary symptom burden were also associated with larger gains in sexual satisfaction, while age and BMI did not show significant independent associations in the adjusted model.

4. Discussion

The present study demonstrates that pelvic floor rehabilitation using electromagnetic stimulation, either alone or combined with structured Kegel exercises, is associated with an improvement in sexual satisfaction among postmenopausal women with urinary incontinence. Importantly, the addition of voluntary pelvic floor muscle training to electromagnetic stimulation resulted in a enhancement of sexual satisfaction compared with electromagnetic therapy alone.

Urinary incontinence markedly reduces sexual satisfaction in women, being associated with decreased sexual desire and intercourse frequency, avoidance of sexual activity, and a high prevalence of sexual dysfunction, particularly in severe cases [10–16]. Mixed and urgency urinary incontinence, as well as coital incontinence, appear to exert the greatest negative impact on sexual satisfaction, an effect that is further amplified by psychological distress, embarrassment, and anticipatory anxiety [10–19]. These observations highlight the close interrelationship between urinary symptoms, emotional wellbeing, and sexual health.

At 3 months, both treatment protocols in the present study produced statistically significant gains in overall sexual satisfaction, supporting the concept that pelvic floor neuromuscular activation plays a key role not only in continence restoration but also in sexual wellbeing. These findings are consistent with previous literature indicating that pelvic floor muscle strengthening improves confidence, body awareness, and sexual comfort in women with pelvic floor dysfunction, including postmenopausal populations [20–24]. Nevertheless, responses in postmenopausal women tend to be more heterogeneous than in premenopausal women and are influenced by menopausal stage, baseline pelvic floor muscle strength, and associated genitourinary symptoms [20–24].

The superior outcomes observed in the combined Emsella and Kegel group suggest a synergistic effect between involuntary, supramaximal pelvic floor contractions induced by electromagnetic stimulation and active, voluntary muscle engagement achieved through Kegel exercises. While electromagnetic stimulation primarily enhances baseline muscle strength and endurance, voluntary pelvic floor muscle training improves motor control, coordination, and proprioceptive awareness—factors that are particularly relevant for sexual comfort and perceived pleasure. Previous studies have shown that improvements in sexual satisfaction following Kegel exercises and electrostimulation are associated with higher baseline pelvic floor muscle strength, preserved voluntary contraction ability, greater sexual activity, younger age or earlier menopausal stage, absence of dyspareunia or severe genitourinary symptoms, and good adherence to exercise protocols [20–25].

Domain-specific analyses revealed that the greatest between-group differences were observed in sexual comfort and in the perceived impact of urinary symptoms on sexual activity. These findings underscore the psychological dimension of sexual satisfaction in women with urinary incontinence, where fear of leakage, embarrassment, and anticipatory anxiety often play a central role. Psychological wellbeing has been shown to strongly predict sexual satisfaction outcomes after pelvic floor interventions; lower levels of depression, anxiety, and stress are associated with greater improvements, whereas psychiatric symptoms may attenuate sexual satisfaction de-

spite objective physical gains [26,27]. In this context, combined pelvic floor and psychological or behavioral interventions have been reported to yield superior sexual satisfaction outcomes compared with pelvic floor muscle training alone, particularly in postmenopausal women, supporting a biopsychosocial approach to female sexual health [26,28].

Moreover, recent evidence demonstrating tissue-level adaptations following short-course balneotherapeutic interventions—such as increased capillary caliber, angiogenesis, and sustained histological changes in dermal and muscular structures [29].

The clinical relevance of combined therapeutic strategies is further supported by evidence from studies evaluating multimodal approaches in women with urinary disorders. Previous research has demonstrated that the association of Kegel exercises with pharmacological treatment is significantly more effective than medication alone in reducing urinary incontinence and improving quality of life, including sexual life, in women with overactive bladder and mixed urinary incontinence [30]. Similarly, combining Kegel exercises with local vaginal estriol therapy has been shown to be more effective than estriol alone in alleviating symptoms of atrophic vulvovaginitis in postmenopausal women, particularly in moderate and severe forms [31]. These findings reinforce the concept that pelvic floor muscle training enhances the effectiveness of adjunctive therapies targeting urogenital health and sexual wellbeing.

The proportion of women achieving a clinically meaningful improvement in sexual satisfaction was significantly higher in the combined-therapy group, underscoring the practical importance of the observed differences. Notably, this benefit was preserved across menopausal-duration subgroups, suggesting that even women with longer-standing hypoestrogenic changes may derive meaningful sexual benefits from combined pelvic floor rehabilitation strategies.

Electrostimulation and other energy-based therapies, such as radiofrequency, have been reported to improve sexual function in selected populations, particularly postmenopausal women with genitourinary syndrome of menopause; however, results remain inconsistent and these modalities are not clearly superior to Kegel exercises when used in isolation [2-4,6,7,22,29,32,33,34]. Taken together with the present findings, this supports the view that electromagnetic stimulation may be most effective when integrated into a broader rehabilitation framework rather than applied as a stand-alone intervention.

More broadly, urinary incontinence in menopausal women represents a frequent, multifactorial condition with a substantial impact on quality of life, often evolving from stress incontinence to urgency and mixed forms with advancing age. Optimal management therefore requires a personalized, multimodal approach that may include conservative measures such as pelvic floor muscle training, hormonal therapies, minimally invasive interventions, and, when necessary, surgical options [35]. Within this framework, combined pelvic floor rehabilitation strategies appear particularly well suited to address both functional and quality-of-life outcomes, including sexual satisfaction.

Multivariable analyses in the present study confirmed that treatment allocation remained an independent predictor of improved sexual satisfaction after adjustment for potential confounders, including age, body mass index, menopausal duration, and baseline urinary symptom severity. This finding supports a direct effect of the combined intervention on sexual satisfaction beyond its indirect impact on continence alone.

Several limitations should be acknowledged. Sexual satisfaction was assessed using a study-specific questionnaire rather than a widely standardized sexual function instrument; however, this approach allowed for targeted evaluation of satisfaction-related domains that are particularly relevant to women with urinary incontinence. In addition, the relatively short follow-up period limits conclusions regarding the durability of sexual satisfaction improvements. Direct comparative evidence between premenopausal and postmenopausal women remains limited, and further

studies are required to define long-term efficacy and optimal treatment protocols [36-40].

The microbiome of the urinary bladder and intestinal tract plays a key role in maintaining genitourinary health, good functionality, and the prevention of possible infections with pathogenic germs [41]. These changes in the microbiome can lead to colonization of the bladder with inappropriate enterobacterial germs that can mimic a urinary tract infection with implications for bladder motility and sensitivity.

Although safe, both Kegel exercises and pelvic floor muscle stimulation should be recommended with some caution to patients with serious heart problems associated with an increased risk of myocardial infarction or cardiac arrest [42].

Despite these limitations, the strengths of this study include its prospective design, well-defined intervention protocols, high adherence rates, and the inclusion of a clinically relevant postmenopausal population. Overall, the findings suggest that combining electromagnetic pelvic floor stimulation with voluntary pelvic floor muscle training represents an effective, non-invasive strategy for improving sexual satisfaction in women with urinary incontinence.

In the future, we are also considering a multicenter expansion of our study.

5. Conclusions

Pelvic floor rehabilitation using electromagnetic stimulation improves sexual satisfaction in postmenopausal women with urinary incontinence. The addition of structured Kegel exercises to electromagnetic therapy provides a clinically meaningful and statistically additional benefit, leading to greater improvements in overall sexual satisfaction, sexual comfort, and the perceived impact of urinary symptoms during sexual activity.

These findings support the use of combined pelvic floor rehabilitation strategies not only for continence management but also for addressing sexual well-being in postmenopausal women. Given its non-invasive nature, good tolerability, and favorable patient-reported outcomes, the combination of electromagnetic stimulation and voluntary pelvic floor muscle training should be considered a valuable therapeutic option for improving sexual satisfaction in this population.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. All patients admitted to our clinic gave their consent for their clinical data to be included in studies respecting their confidentiality.

Data Availability Statement: The data supporting this study's findings are available on request from the corresponding author, Lucian Șerbănescu.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

UI	Urinary incontinence
SUI	Stress urinary incontinence
UUI	Urgency urinary incontinence
MUI	Mixed urinary incontinence
PFMT	Pelvic floor muscle training
ICIQ-UI SF	International Consultation on Incontinence Questionnaire—Urinary Incontinence Short Form
SSS-UI-12	Sexual Satisfaction Questionnaire in the Context of Urinary Incontinence
FSFI	Female Sexual Function Index

References

1. Jorge, C. H.; Bø, K.; Chiazuto Catai, C.; Oliveira Brito, L. G.; Driusso, P.; Kolberg Tennfjord, M. Pelvic floor muscle training as treatment for female sexual dysfunction: a systematic review and meta-analysis. Am J Obstet Gynecol. 2024, 231(1), 51–66.e1. doi: 10.1016/j.ajog.2024.01.001.
2. Tekbaş S. The effect of pelvic floor muscle exercise on sexual function in women of reproductive age: A randomized controlled trial. Medicine (Baltimore). 2025, 104(37), e44324. doi: 10.1097/MD.0000000000044324.
3. Nazarpour, S.; Simbar, M.; Ramezani Tehrani, F.; Alavi Majd, H. Effects of Sex Education and Kegel Exercises on the Sexual Function of Postmenopausal Women: A Randomized Clinical Trial. J Sex Med. 2017, 14(7), 959–967. doi: 10.1016/j.jsxm.2017.05.006.
4. Khosravi, A.; Riazi, H.; Simbar, M.; Montazeri, A. Effectiveness of Kegel exercise and lubricant gel for improving sexual function in menopausal women: A randomized trial. Eur J Obstet Gynecol Reprod Biol. 2022, 274, 106–112. doi: 10.1016/j.ejogrb.2022.05.022.
5. Zhang, M.; Zhu, M.; Zhang, X.; Ren, J.; Jia, F. Effects of Kegel exercise combined with rational emotive behavior therapy on pelvic floor muscle function and sexual life quality in patients with total hysterectomy: A retrospective study. Medicine (Baltimore). 2023, 102(52), e36222. doi: 10.1097/MD.0000000000036222.
6. Aalaie, B.; Tavana, B.; Rezasoltani, Z.; Aalaei, S.; Ghaderi, J.; Dadarkhah, A. Biofeedback versus electrical stimulation for sexual dysfunction: a randomized clinical trial. Int Urogynecol J. 2021, 32(5), 1195–1203. doi: 10.1007/s00192-020-04373-7.
7. Aydın, S.; Arıoğlu Aydın, Ç.; Batmaz, G.; Dansuk, R. Effect of vaginal electrical stimulation on female sexual functions: a randomized study. J Sex Med. 2015, 12(2), 463–469. doi: 10.1111/jsm.12788.
8. Zimmerman, L. L.; Gupta, P.; O'Gara, F.; Langhals, N. B.; Berger, M. B.; Bruns, T. M. Transcutaneous Electrical Nerve Stimulation to Improve Female Sexual Dysfunction Symptoms: A Pilot Study. Neuromodulation. 2018, 21(7), 707–713. doi: 10.1111/ner.12846.
9. Bottorff, E. C.; Gupta, P.; Ippolito, G. M.; Moore, M. B.; Rodriguez, G. M.; Bruns, T. M. Short-Term Dorsal Genital Nerve Stimulation Increases Subjective Arousal in Women With and Without Spinal Cord Injury: A Preliminary Investigation. Neuromodulation. 2024, 27(4), 681–689. doi: 10.1016/j.neurom.2024.02.004.
10. Burzynski, B.; Gibala, P.; Soltysiak-Gibala, Z.; Jurys, T.; Przymuszala, P.; Rzymski, P.; Stojko, R. How Urinary Incontinence Affects Sexual Activity in Polish Women: Results from a Cross-Sectional Study. Int J Environ Res Public Health. 2022, 19(21), 13818. doi: 10.3390/ijerph192113818.
11. Caruso, S.; Brescia, R.; Matarazzo, M. G.; Giunta, G.; Rapisarda, A. M. C.; Cianci, A. Effects of Urinary Incontinence Subtypes on Women's Sexual Function and Quality of Life. Urology, 2017, 108, 59–64. doi: 10.1016/j.urology.2017.06.025.
12. Gomes, T. A.; Faber, M. A.; Botta, B.; Brito, L. G. O.; Juliato, C. R. T. Severity of urinary incontinence is associated with prevalence of sexual dysfunction. Int Urogynec J. 2020, 31(8), 1669–1674. doi: 10.1007/s00192-019-04092-8.
13. Su, C. C.; Sun, B. Y.C., Jiann, B. P. Association of urinary incontinence and sexual function in women. Int J Urol. 2015, 22(1), 109–113. doi: 10.1111/iju.12610.
14. Nilsson, M.; Lalos, O.; Lindkvist, H.; Lalos, A. How do urinary incontinence and urgency affect women's sexual life? Acta Obstet Gynecol Scand. 2011, 90(6), 621–628. doi: 10.1111/j.1600-0412.2011.01120.x.
15. Burzyński, B.; Kwiatkowska, K.; Sołtysiak-Gibała, Z.; Bryniarski, P.; Przymuszała, P.; Wlaźlak, E.; Rzymski, P. Impact of stress urinary incontinence on female sexual activity. Eur Rev Med Pharmacol Sci. 2021, 25(2), 643–653. doi: 10.26355/eurrev_202101_24622.
16. Illiano, E.; Mahfouz, W.; Giannitsas, K.; Kocjancic, E.; Vittorio, B.; Athanasopoulos, A.; Balsamo, R.; Natale, F.; Carbone, A.; Villari, D.; Filocamo, M. T.; Finazzi Agrò, E.; Costantini, E. Coital Incontinence in Women With Urinary Incontinence: An International Study. J Sex Med. 2018, 15(10), 1456–1462. doi: 10.1016/j.jsxm.2018.08.009.

17. Tian, Z.; Wang, X.; Fu, L.; Du, Z.; Lin, T.; Chen, W.; Sun, Z. Health-related quality of life and sexual function among women with overweight or obesity and urinary incontinence: a cross-sectional study. Qual Life Res. 2025, 34(10), 3007–3016. doi: 10.1007/s11136-024-03868-w.
18. Karbage, S. A.; Santos, Z. M.S.A.; Frota, M. A.; de Moura, H. J.; Vasconcelos, C. T.M.; Neto, J. A.V.; Bezerra, L. R.P.S. Quality of life of Brazilian women with urinary incontinence and the impact on their sexual function. Eur J Obstet Gynecol Reprod Biol. 2016, 201, 56–60. doi: 10.1016/j.ejogrb.2016.03.025.
19. Lau, H. H.; Huang, W. C.; Su, T. H. Urinary leakage during sexual intercourse among women with incontinence: Incidence and risk factors. PloS One. 2017, 12(5), e0177075. doi: 10.1371/journal.pone.0177075.
20. Mohktar, M. S.; Ibrahim, F.; Mohd Rozi, N. F.; Mohd Yusof, J.; Ahmad, S. A.; Su Yen, K.; Omar, S. Z. A quantitative approach to measure women's sexual function using electromyography: a preliminary study of the Kegel exercise. Med Sci Monit. 2013, 19, 1159–1166. doi: 10.12659/MSM.889628.
21. Ferreira, L. A.; Fitz, F. F.; Cruz, M. A.; Gimenez, M. M.; Matias, M. M. P.; Bortolini, M. A. T.; Castro, R. A. Comparison of Pelvic Floor Muscle Function Between Sexually Active and Sexually Inactive Women with Pelvic Floor Dysfunction: Retrospective Cross-Sectional Study. Int Urogynecol J. 2025. doi: 10.1007/s00192-025-06352-2. Advance online publication.
22. Tosun, Ö. Ç.; Mutlu, E. K.; Tosun, G.; Ergenoğlu, A. M.; Yeniel, A. Ö.; Malkoç, M.; Aşkar, N.; İtil, İ. M. Do stages of menopause affect the outcomes of pelvic floor muscle training? Menopause. 2015, 22(2), 175–184. doi: 10.1097/GME.0000000000000278.
23. Schvartzman, R.; Bertotto, A.; Schvartzman, L.; Wender, M. C.O. Pelvic floor muscle activity, quality of life, and sexual function in peri- and recently postmenopausal women with and without dyspareunia: a cross-sectional study. J Sex Marital Ther. 2014, 40(5), 367–378. doi: 10.1080/0092623X.2013.864363.
24. Hentzen, C.; Musco, S.; Amarenco, G.; Del Popolo, G.; Panicker, J. N. Approach and management to patients with neurological disorders reporting sexual dysfunction. Lancet Neurol. 2022, 21(6), 551–562. doi: 10.1016/S1474-4422(22)00036-9.
25. Lara, L. A.; Montenegro, M. L.; Franco, M. M.; Abreu, D. C.; Rosa e Silva, A. C.; Ferreira, C. H. Is the sexual satisfaction of postmenopausal women enhanced by physical exercise and pelvic floor muscle training? J Sex Med. 2012, 9(1), 218–223. doi: 10.1111/j.1743-6109.2011.02516.x.
26. Brotto, L.; Atallah, S.; Johnson-Agbakwu, C.; Rosenbaum, T.; Abdo, C.; Byers, E. S.; Graham, C.; Nobre, P.; Wylie, K. Psychological and Interpersonal Dimensions of Sexual Function and Dysfunction. J Sex Med. 2016, 13(4), 538–571. doi: 10.1016/j.jsxm.2016.01.019.
27. Baszak-Radomańska, E.; Wańczyk-Baszak, J.; Paszkowski, T. Women's sexual health improvement: sexual quality of life and pelvic floor muscle assessment in asymptomatic women. Front Med (Lausanne). 2024, 11, 1289418. doi: 10.3389/fmed.2024.1289418.
28. Carcelén-Fraile, M. D. C.; Aibar-Almazán, A.; Martínez-Amat, A.; Cruz-Díaz, D.; Díaz-Mohedo, E.; Redecillas-Peiró, M. T.; Hita-Contreras, F. Effects of Physical Exercise on Sexual Function and Quality of Sexual Life Related to Menopausal Symptoms in Peri- and Postmenopausal Women: A Systematic Review. Int J Environ Res Public Health. 2020, 17(8), 2680. doi: 10.3390/ijerph17082680.
29. Surdu, T.-V.; Surdu, M.; Surdu, O.; Franciuc, I.; Tucmeanu, E.-R.; Tucmeanu, A.-I.; Serbanescu, L.; Tica, V.I. Microvascular Responses in the Dermis and Muscles After Balneotherapy: Results from a Prospective Pilot Histological Study. Water 2025, 17, 1830. https://doi.org/10.3390/w17121830.
30. Șerbănescu, L.; Rotar, V.; Brezeanu, D.; Mirea, S.; Ionescu, E.-V.; Ionescu, P. Evaluating the Efficacy of Combined Intravaginal Estriol Therapy and Kegel Exercises in Managing Menopausal Atrophic Vulvovaginitis. Clin Pract. 2025, 15(1), 20. doi: 10.3390/clinpract15010020.
31. Șerbanescu, L.; Rotar, V.; Ionescu, E.-V.; Ciota, A.-E.; Mirea, S.; Ionescu, P.; Costea, A. C. The role of Kegel exercises in reducing involuntary loss of urine in overactive bladder and mixed urinary incontinence. Balneo and PRM Research Journal. 2024, 15(4), 757. doi: 10.12680/balneo.2024.757.
32. Potter, J. E. A 60-year-old woman with sexual difficulties. JAMA. 2007, 297(6), 620–633. doi: 10.1001/jama.297.6.620.
33. Lunardi, A. C.; Foltran, G. C.; Carro, D. F.; Silveira, L. T. Y.; Haddad, J. M.; Ferreira, E. A. G. Efficacy of electrical stimulation in comparison to active training of pelvic floor muscles on stress urinary incontinence symptoms in women: a systematic review with meta-analysis. Disabil Rehabil. 2025, 47(13), 3256–3267. doi: 10.1080/09638288.2024.2419424.
34. Gueldini de Moraes, A. V.; Costa-Paiva, L.; Machado, H. D. C.; Pedro, A. O. Sexual function after treatment with non-invasive radiofrequency device for improvement of the genitourinary syndrome of menopause: A multi-arm randomized clinical trial. Eur J Obstet Gynecol Reprod Biol. 2025, 306, 117–124. doi: 10.1016/j.ejogrb.2025.01.015.
35. Șerbănescu, L.; Mirea, S.; Ionescu, P.; Petrica, L. A.; Iorga, I. C.; Surdu, M.; Surdu, T. V.; Rotar, V. Involuntary Urine Loss in Menopause—A Narrative Review. J Clin Med., 2025, 14(21), 7664. doi: 10.3390/jcm14217664.
36. Stewart, F.; Berghmans, B.; Bø, K.; Glazener, C. M. Electrical stimulation with non-implanted devices for stress urinary incontinence in women. Cochrane Database Syst Rev. 2017, 12(12), CD012390. doi: 10.1002/14651858.CD012390.pub2.
37. Yu, T. Y.; Yu, C. Y.; Escorpizo, R.; Liou, T. H.; Wu, C. W.; Chen, H. C. Comparison of nonimplantable electrical stimulation in women with urinary incontinence: a systematic review and network meta-analysis of randomized controlled trials. Sci Rep. 2024, 14(1), 26957. doi: 10.1038/s41598-024-78358-7.

38. Chêne, G.; Mansoor, A.; Jacquetin, B.; Mellier, G.; Douvier, S.; Sergent, F.; Aubard, Y.; Seffert, P. Female urinary incontinence and intravaginal electrical stimulation: an observational prospective study. Eur J Obstet Gynecol Reprod Biol. 2013, 170(1), 275-80. doi: 10.1016/j.ejogrb.2013.06.011.
39. O'Reilly, N.; Nelson, H. D.; Conry, J. M.; Frost, J.; Gregory, K. D.; Kendig, S. M.; Phipps, M.; Salganicoff, A.; Ramos, D.; Zahn, C.; Qaseem, A. Screening for urinary incontinence in women: A recommendation from the Women's Preventive Services Initiative. Ann Intern Med. 2018, 169(5), 320–328. doi: 10.7326/M18-0595.
40. Lukacz, E. S.; Santiago-Lastra, Y.; Albo, M. E.; Brubaker, L. Urinary incontinence in women: A review. JAMA. 2017, 318(16), 1592–1604. doi: 10.1001/jama.2017.12137.
41. Alexandrescu, L.; Tofolean, I.T.; Condur, L.M.; Tofolean, D.E.; Nicoara, A.D.; Serbanescu, L.; Rusu, E.; Twakor, A.N.; Dumitru, E.; Dumitru, A.; et al. Smart Microbiomes: How AI Is Revolutionizing Personalized Medicine. Bioengineering. 2025, 12, 944. doi: 10.3390/bioengineering12090944.
42. Nicoara, A.D.; Alexandrescu, I.; Tofolean, D.E.; Iliescu, M.G.; Condur, L.M.; Tofolean, I.T. The Impact of Cardiac Rehabilitation on Quality of Life in Elderly Heart Failure Patients – Literature Review. Balneo and PRM Research Journal. 2024, 15(3):723. doi: 10.12680/balneo.2024.723.