Supplementary Material

Combination of non-ablative Er:YAG laser and magnetic stimulation for the treatment of urinary incontinence: A single-arm pilot study

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Note: references of this supplemental material align with those of the full list of text.

i) Appendix to Methods section

Exclusion criteria for patient selection

Participants were excluded under the following circumstances: very severe urinary incontinence (ICIQ-UI SF score at baseline >19), pregnancy, body mass index (BMI >35 kg/m^2), unwillingness to abstain from vaginal intercourse for one week after laser therapy, acute urinary tract infection (UTI), a history of genital fistula, a thin recto-vaginal septum, or a history of fourth-degree laceration (i.e. perineal body), active sexually transmitted diseases that preclude treatment, or other vaginal infections, grade 2 or higher genital prolapse, a history of radiation therapy for cervical or uterine cancer, medical conditions that may interfere with participants' adherence to the protocol (i.e. contraindicated for laser and High Intensity Tesla magnetic Stimulation [HITS] therapy), and prior laser or HITS treatment for urinary incontinence.

Laser and HITS treatment parameters

The IncontiLase® protocol (Fotona, Slovenia) followed the standard parameters established by the manufacturer and was performed using the G-Runner robotic handpiece. Briefly, the protocol consists of three steps: (i) intravaginal laser treatment of the anterior vaginal wall (7 mm spot, 10 J/cm^2, 2 Hz, four pulses, one pass); (ii) intravaginal laser treatment of the entire vaginal canal (7 mm spot, 3.5 J/cm^2, 3.3 Hz, four pulses, two passes); and (iii) treatment of the vestibule and introitus (7 mm spot, 10 J/cm^2, 1.6 Hz, two pulses, two to three passes, 10% overlap). The treatment time was 20 min/session.

The HITS parameters were as follows: stimulation intensity up to the limit of the patient's tolerance, increasing frequencies of 10, 23, and 35 Hz, each for 10 minutes with a 5-second rest interval between active cycles. The total duration of the treatment was 30 min/session.

Questionnaires used for the self-assessment of patient's symptoms

International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF)

The ICIQ-UI SF is a questionnaire designed to assess the impact of urinary incontinence on quality of life [22]. It contains four questions, three of which are scored. They relate to the frequency and amount of urine loss, and the impact on daily life. The ICIQ-UI SF scores are categorized as: no incontinence or dry (score 0), mild (score 1–5), moderate (6–12), severe (13–18), and very severe (19–21) incontinence [22]. The minimum important difference (MID) in the ICIQ-UI SF score to claim a change in the score to be clinically relevant was reported as -2.52 [23].

Questionnaire for Urinary Incontinence Diagnosis (QUID)

The QUID questionnaire was used to diagnose the type of urinary incontinence each individual was suffering from. It contains 6 specific questions about the circumstances and symptoms of urine leakage, ranging in frequency from "none of the time" (score 0) to "all of the time" (score 5). The first three questions relate to the stress urinary incontinence (SUI) domain and the last three to the urge urinary incontinence (UUI) domain. The score for each domain is calculated by summing the responses of each item (each on a scale of 0–15, with higher scores indicating worse urinary

incontinence [24]. A cutoff score of ≥4 or ≥6 indicates SUI or UUI, respectively, and the presence of both indicates the MUI type [24].

Female Sexual Function Index (FSFI)

The FSFI is a 19-item questionnaire designed to assess sexual function in women [25]. It measures various aspects of sexual function and covers six domains: sexual desire, arousal, lubrication, orgasm, satisfaction, and pain. Each of the 19 questions is scored on a scale from 0 to 5, with a higher score indicating better sexual function. The total FSFI score (maximum 36) is the sum of the scores obtained for each of the six domains multiplied by a correction factor [25]. A total score below the value of 26.55 is considered to be clinically relevant female sexual dysfunction (FSD). The FSFI questionnaire can only be completed by sexually active women who attempted vaginal penetration in the last month [25].

ii) Supplementary Figure

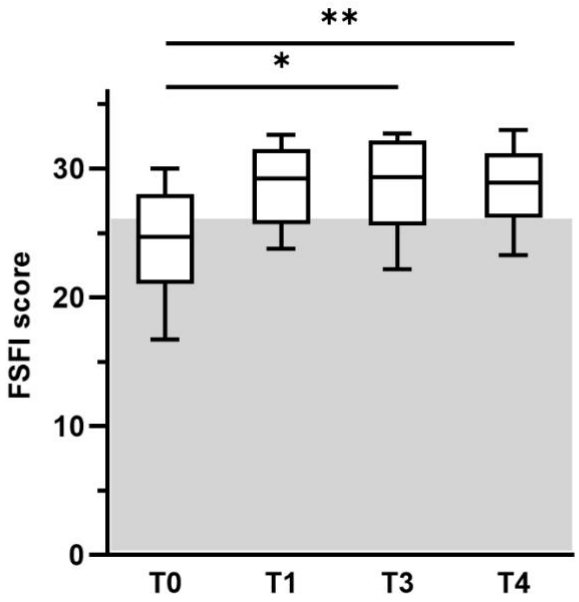

Figure S1. Effect of treatment on female sexual function based on total FSFI scores. In the box plots, the middle line is the median and the whiskers are the minimum and maximum values. *P**<0.05; *p***<0.01. The grey area shows the suggested diagnostic cutoff for female sexual dysfunction [25]. Number of included patients: T0, *n*=22; T1, *n*=22; T3, *n*=20; T4, *n*=20. T0, baseline; T1, after laser; T3, 3 months follow-up; T4, 6 months follow-up. The questionnaire was not completed at the end of HITS therapy, T2.

iii) Supplementary Tables

Table S1. Baseline demographics and clinical characteristics of patients (*n*=24).

Characteristic	Mean (SD)	Median [min, Max]	Total (%)#
Age (years at time of treatment)	42.7 (7.5)	42 [32,61]	
BMI (kg/m2)			
Premenopausal			21 (87.5%)
Postmenopausal			3 (12.5%)

Gravidity	2.0 (0.9)	2.0 [0,3]	23 (95.8%)
Vaginal deliveries	1.6 (0.7)	2.0 [0,3]	23 (95.8%)
C-section	0.2 (0.5)	0 [0,2]	4 (16.7%)
Hysterectomy			0 (0%)
Smoking			0 (0%)
Never smoked			19 (79.2%)
Stopped smoking			5 (20.8%)
ICIQ-UI SF	12.46 (3.40)	13 [4,17]	
QUID	11.46 (4.82)	10.5 [2,14]	
QUID-SUI	8.17 (3.50)	7.5 [2,15]	
QUID-UUI	3.29 (2.87)	3 [0,9]	
FSFI	24.13 (4.23)	24.7 [16.7,30]	

[#]Variable described by the number of participants in each category and their respective proportion.
Abbreviations: BMI, Body Mass Index; ICIQ-UI SF, International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form; QUID-(SUI/UUI), Questionnaire for Urinary Incontinence Diagnosis - (Stress Urinary Incontinence / Urge Urinary Incontinence); FSFI, Female Sexual Function Index.

Table S2. Descriptive statistics for primary outcome measures at distinct time points.

Questionnaire	**Time points**	**Mean**	**SD**	**95% CI**
ICIQ	**T0**	12.46	3.40	11.02, 13.89
	T1	9.08	4.47	7.20, 10.97
	T2	7.21	3.98	5.53, 8.89
	T3	5.95	4.24	4.02, 7.88
	T4	5.48	4.05	3.73, 7.23
QUID	**T0**	11.46	4.82	9.42, 13.49
	T1	7.17	3.91	5.52, 8.82
	T2	4.75	3.37	3.33, 6.17
	T3	4.14	3.10	2.74, 5.54
	T4	3.96	2.65	2.81, 5.10

QUID-SUI	**T0**	3.29	3.50	1.81, 4.77
	T1	4.96	2.63	3.85, 6.07
	T2	3.63	2.70	2.49, 4.76
	T3	3.10	2.51	1.96, 4.23
	T4	3.17	2.55	2.07, 4.27
QUID-UUI	**T0**	3.29	2.87	2.08, 4.50
	T1	2.21	2.34	1.22, 3.20
	T2	1.13	1.98	0.29, 1.96
	T3	1.05	1.69	0.29, 1.81
	T4	0.78	0.90	0.39, 1.17

Abbreviations: BMI, Body Mass Index; ICIQ-UI SF, International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form; QUID-(SUI/UUI), Questionnaire for Urinary Incontinence Diagnosis - (Stress Urinary Incontinence / Urge Urinary Incontinence); SD, Standard Deviation; CI, Confidence Interval. T0, baseline; T1, after laser; T2, after HITS; T3, 3 months follow-up; T4, 6 months follow-up.

Table S3. Change in ICIQ-UI SF scores after treatment. The values were determined by subtracting the ICIQ scores at the indicated time points from the baseline value (T0). The MID for clinical relevance was determined as a reduction of 2.52 points [23]. T1, after laser; T2, after HITS; T3, 3 months follow-up; T4, 6 months follow-up.

Characteristic	**T1**	**T2**	**T3**	**T4**
ICIQ score change: mean (SD)	-3.38 (3.92)	-5.25 (3.91)	-6.61 (3.63)	-7.00 (3.50)
% of patients with ICIQ-UI SF score ≤ MID	45.8%	70.8%	79.2%	91.7%

Table S4. Baseline SUI and UUI symptoms assessed with the QUID-SUI and QUID-UUI scores. A cutoff score of ≥4 indicates the presence of SUI (light grey), a score of ≥6 indicates UUI (grey), and scores exceeding both thresholds indicate MUI [24].

Patient No.	**QUID-SUI**	**QUID-UUI**
1	8	3
2	3	6
3	6	3
4	5	5

5	6	1
6	6	2
7	10	6
8	8	0
9	2	0
10	4	3
11	7	3
12	11	0
13	12	9
14	10	9
15	6	0
16	7	1
17	14	0
18	11	7
19	15	3
20	12	10
21	11	7
22	4	4
23	7	4
24	11	3

Abbreviations: QUID-(SUI/UUI), Questionnaire for Urinary Incontinence Diagnosis - (Stress Urinary Incontinence / Urge Urinary Incontinence); MUI, Mixed Urinary Incontinence.

Table S5. Female sexual function index (FSFI) scores for six individual domains at baseline and after treatment. Shown are the median FSFI scores and the *p*-values for the comparison of the initial values (T0) with the results after laser treatment (T1) and with the results after 3 months (T3) and 6 months (T4). Value range intervals (min-max) [25]: Desire (1.2-6.0), arousal (0-6.0), lubrication (0-6.0), orgasm (0-6.0), satisfaction (0.8-6.0), pain (0-6.0). *P*-values <0.05 are statistically significant and are shown in bold.

	Median [Min, max]				***p*-value**		
	T0	**T1**	**T3**	**T4**	**T0-T1**	**T0-T3**	**T0-T4**
Desire	3.0 [2.4, 4.2]	3.6 [2.4, 4.8]	3.6 [2.4, 4.8]	3.6 [1.2, 5.4]	0.219	**0.030**	**0.017**
Arousal	4.2 [1.8, 6.0]	4.8 [3.6, 6.0]	5.1 [4.2, 6.0]	5.1 [3.0, 6.0]	0.102	**0.000**	**0.002**
Lubrication	4.8 [2.1, 6.0]	5.4 [2.1, 6.0]	5.3 [3.0, 6.0]	5.7 [3.3, 6.0]	**0.007**	0.309	**0.005**
Orgasm	3.0 [2.4, 4.2]	3.6 [2.4, 4.8]	3.9 [2.4, 4.8]	3.6 [1.2, 5.4]	1.000	0.121	0.411
Satisfaction	4.8 [2.4, 6.0]	5.2 [1.6, 6.0]	5.4 [3.2, 6.0]	5.0 [2.8, 6.0]	0.059	**0.022**	**0.033**
Pain	4.8 [3.2, 6.0]	6.0 [4.4, 6.0]	6.0 [4.0, 6.0]	5.8 [4.4, 6.0]	0.424	0.728	0.728

Table S6. Paired comparison of muscle strength before, in the middle and after treatment. T0, before treatment; T1, after laser; T2, after HITS; T3, 3 months follow-up; T4, 6 months follow-up. *P*-values <0.05 are statistically significant and are shown in bold.

	T0-T1	**T0-T2**	**T0-T3**	**T0-T4**	**T1-T2**	**T1-T3**	**T1-T4**	**T2-T3**	**T2-T4**	**T3-T4**
p-value	0.707	**0.002**	**0.034**	**0.021**	**0.025**	0.271	0.194	0.231	0.420	0.794