

Research Article

The Effects of Vaginal Laser Therapy on Sexual Quality of Life in Patients with Genitourinary Syndrome of Menopause (GSM)

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- Sexual Function; Genitourinary Syndrome of Menopause (GSM); Laser Therapy; Quality of Life; Vaginal Atrophy; Hormone Replacement Therapy (HRT); Menopause

Abstract

Background: Genitourinary syndrome of menopause (GSM) is a chronic and progressive syndrome that markedly impairs sexual quality of life in postmenopausal women. While vaginal laser therapy has emerged internationally as a promising non-hormonal treatment, data from Asian populations remain limited.

Aim: To evaluate the effects of fractional CO₂ vaginal laser therapy on sexual quality of life in Taiwanese women with GSM, with subgroup analysis by recent hormone replacement therapy (HRT) exposure.

Methods: This retrospective single-center study included 27 postmenopausal women treated at a secondary teaching hospital in Taiwan from August 2022 to September 2024. All underwent three sessions of SmartXide² CO₂ vaginal laser therapy. Sexual quality of life was assessed with the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire short form (PISQ-12, item 5-8) and a Sexual Satisfaction Visual Analog Scale (VAS) at baseline, 3, 6, and 12 months.

Outcomes: The primary outcome was improvement in PISQ-12 short form scores and Sexual Satisfaction VAS score across the study period, with subgroup analysis by HRT status.

Results: The mean PISQ-12 short form score improved from 9.9 ± 4.7 to 12.7 ± 3.5 (p = 0.004). Significant improvement was observed in the non-HRT group (p = 0.008), but not in the HRT group (p = 0.154). In longitudinal analysis, the non-HRT group demonstrated sustained increases in Sexual Satisfaction VAS score up to 12 months (all p < 0.01 vs baseline), whereas the HRT group showed only transient, non-significant changes.

Clinical Implications: Fractional CO₂ vaginal laser therapy may serve as a valuable non-hormonal option for GSM, particularly for women who are not candidates for or do not respond well to HRT.

Strengths & Limitations: This study used a standardized laser protocol in an Asian cohort, enhancing validity and local relevance, but its retrospective single-center design, small sample size, self-reported measures, and short follow-up limit generalizability.

Conclusions: Fractional CO₂ vaginal laser therapy improved sexual quality of life in postmenopausal women with GSM, with sustained benefits most evident in those without recent HRT exposure. It may represent a valuable alternative for patients who are not candidates for or do not respond to hormone therapy.

ABBREVIATIONS

GSM: Genitourinary Syndrome of Menopause; HRT: Hormone Replacement Therapy; PISQ-12: Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire-12; VAS: Visual Analog Scale; BMI: Body Mass Index

INTRODUCTION

The genitourinary syndrome of menopause (GSM) is a relatively new term that replaces previous terminology such as vulvovaginal atrophy, atrophic vaginitis, and urogenital atrophy [1]. GSM is a chronic and progressive condition affecting the vulvovaginal area, sexual function,

and lower urinary tract, primarily resulting from estrogen deficiency. Approximately 40–54% of postmenopausal women and 15% of premenopausal women are affected by GSM, yet only a small proportion seek medical consultation [2].

Common symptoms include vaginal dryness, irritation, burning, dyspareunia, recurrent urinary tract infections, and urinary incontinence [3]. Studies have shown that these symptoms significantly impact women's ability to achieve sexual enjoyment (75%), their relationship with their partner (67%), and their sexual spontaneity (66%) [4]. These symptoms can greatly affect the quality of

life (QOL) of women, especially those who are sexually active [3]. Nonhormonal therapies, such as lubricants and moisturizers, are recommended as first-line treatments to relieve symptoms, while the gold standard is represented by topical estrogen therapy [5].

Recent studies have shown that fractionated CO₂ vaginal laser therapy provides improvements in GSM symptoms, sexual function, and overall patient satisfaction that are comparable to those achieved with vaginal estrogen treatment [6]. The vaginal laser works through activation of regenerative mechanisms in the connective tissue—stimulating the formation of new blood vessels, dermal papillae, and collagen—and in the epithelium, resulting in thickening and desquamation of epithelial cells [7]. These changes lead to remodeling of the vaginal tissue and improved lubrication, which ultimately contribute to symptom relief in GSM [6].

However, local data on the use of vaginal laser therapy for GSM in Taiwan remain limited, and few studies have specifically explored its effect on sexual quality of life in this population. Therefore, this study is based on the initial results from Taipei City Hospital and aims to evaluate the effects of vaginal laser therapy on sexual quality of life in patients with GSM.

MATERIALS AND METHODS

Study design

This retrospective single-center study was conducted at a secondary teaching hospital in Taiwan. The study aimed to evaluate improvements in sexual quality of life among postmenopausal women suffering from GSM following vaginal laser therapy. Patients were selected between August 2022 and September 2024.

Inclusion criteria included postmenopausal women who had completed at least three sessions of vaginal laser therapy and had fully completed the associated questionnaires during treatment.

Exclusion criteria included the absence of sexual activity within the past year, incomplete treatment with fewer than three vaginal laser sessions, missing questionnaire or demographic data, and premenopausal status at the time of treatment.

Procedure

Patients who met the inclusion criteria underwent vaginal laser therapy at Taipei City Hospital, Renai Branch. The treatment was performed using the SmartXide² CO₂ laser system and incorporated three different types of

laser probes during each session: a 360-degree probe, a 90-degree single-mirror probe, and a straight vulvar probe. For the 360-degree probe, the energy settings were 30 W of power, with a 1000 microseconds pulse duration, 1000 micrometers spacing, a pulse stack of 2, and the D-Pulse mode. The 90-degree single-mirror probe utilized the same energy parameters but was applied three times, specifically targeting the anterior vaginal wall at the 11, 12, and 1 o'clock positions. The straight vulvar probe was set to deliver 4.0 W of power, with an 800 microsecond pulse duration, 1000 micrometer spacing, a pulse stack of 1, and the D-Pulse mode. Each patient received a total of three treatment sessions, spaced one month apart. All procedures were conducted in an outpatient setting, without the use of anesthesia or analgesic medication.

Assessment

Sexual quality of life was assessed before and after the third session of vaginal laser therapy using the Short Form of Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12), specifically items 5 through 8 (Table 1). These four questions were selected because they are more directly related to GSM, whereas other items in the questionnaire (e.g., “Does your partner have a problem with erections that affects your sexual activity?” or “Does your partner have a problem with premature ejaculation that affects your sexual activity?”) were considered less relevant to the scope of this study and thus excluded. Additionally, patients were followed up through telephone interviews conducted one year after the initiation of treatment. During these interviews, participants were asked to subjectively assess their sexual quality of life by considering multiple factors, including vaginal dryness, dyspareunia, and recurrent infections. A self-reported 10-point scale, referred to as the Sexual Satisfaction VAS Score, was used to quantify their experiences, with 0 indicating the lowest level of satisfaction and 10 indicating the highest (Figure 1). Patients were asked to rate their sexual quality of life at four specific time points: prior to

Table 1: PISQ-12 short form items

	Always	Usually	Sometimes	Seldom	Never
Do you feel pain during sexual intercourse?	4	3	2	1	0
Are you incontinent (leak urine) with sexual activity?	4	3	2	1	0
Does fear of incontinence (either stool or urine) restrict your sexual activity?	4	3	2	1	0
Do you avoid sexual intercourse because of bulging in the vagina (either bladder, rectum or vagina falling out)?	4	3	2	1	0

PISQ-12 short form (items 5–8) used for sexual quality of life assessment in patients with GSM.

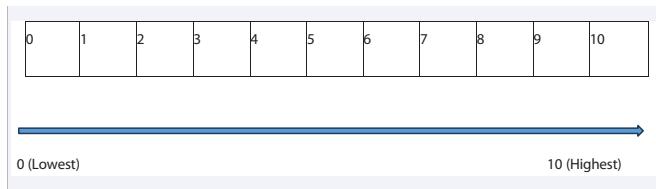


Figure 1 Sexual Satisfaction VAS score used for subjective assessment of sexual quality of life, ranging from 0 (lowest satisfaction) to 10 (highest satisfaction).

treatment, three months after the initiation of treatment (i.e., upon completion of all three vaginal laser sessions), six months after treatment initiation, and one year after treatment initiation.

Statistical analysis

Statistical analyses were performed using SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean and standard deviation (SD). Descriptive statistics were used to present baseline demographic and clinical characteristics. Independent-samples t-tests were applied to compare baseline variables between patients who had and had not received hormone replacement therapy (HRT) in the past year. Paired-samples t-tests were used to assess changes in sexual quality of life, as measured by the PISQ-12 short form, before and after vaginal laser therapy. Longitudinal changes in Sexual Satisfaction VAS scores across four time points—prior to treatment, three months after initiation of treatment (i.e., upon completion of three vaginal laser sessions), six months after initiation, and one year after initiation—were evaluated using repeated-measures analysis of variance (ANOVA). Where appropriate, post hoc pairwise comparisons with Bonferroni adjustment were conducted to identify significant differences between time points. A *p*-value of <0.05 was considered statistically significant.

RESULTS

A total of 39 patients were initially assessed for eligibility (Figure 2). Twelve patients were excluded because they had not been sexually active in the past year, leaving 27 participants who were enrolled and completed the full course of vaginal laser treatment.

The overall mean age of participants was 55.89 years ($SD = 5.80$), with a range from 46 to 69 years. The mean body mass index (BMI) was 22.88 ($SD = 3.68$), ranging from 16.0 to 32.5. The mean number of pregnancies was 1.44 ($SD = 0.89$), with a range from 0 to 3.

Participants were further divided into two groups based on whether they had received HRT in the past year:

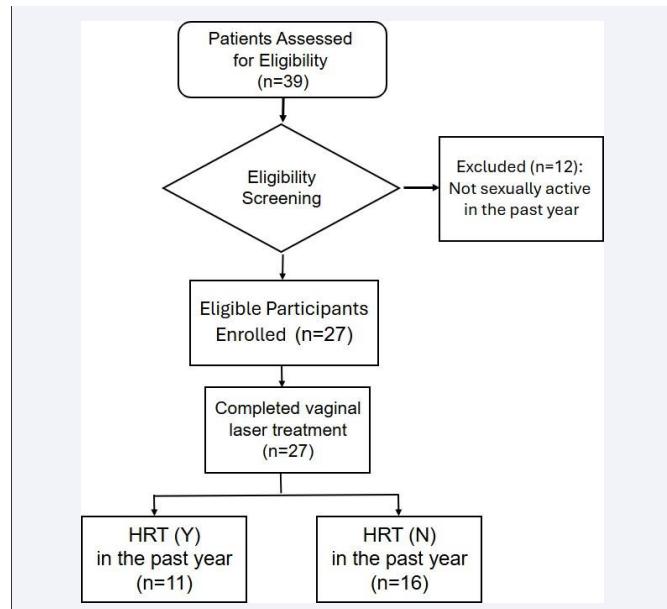


Figure 2 Study flow diagram Flow diagram showing patient enrollment, exclusion, and subgroup classification according to hormone replacement therapy (HRT) exposure.

11 in the HRT group and 16 in the non-HRT group. Among HRT users, the mean age was 55.82 years ($SD = 5.17$), BMI was 22.22 ($SD = 2.52$), and gravidity was 1.36 ($SD = 1.12$).

Among non-users, the mean age was 55.94 years ($SD = 6.36$), BMI was 23.33 ($SD = 4.32$), and gravidity was 1.50 ($SD = 0.73$). Baseline characteristics were comparable between groups (Table 2).

Independent-samples t-tests indicated no statistically significant differences between the two groups in age ($p = 0.959$), BMI ($p = 0.406$), or gravidity ($p = 0.704$), confirming that baseline characteristics were comparable.

Improvement in PISQ-12 short form

Among all 27 participants, vaginal laser treatment led to a significant improvement in sexual quality of life, as measured by the PISQ-12 short form questionnaire.

The overall mean PISQ-12 short form score increased from 9.85 ($SD = 4.70$) before treatment to 12.67 ($SD = 3.50$) after treatment. A paired-samples t-test confirmed this improvement was statistically significant, $t(26) = -3.113, p = 0.004$.

Further analysis was conducted based on whether the patients had undergone HRT in the past year. In the non-HRT group ($n = 16$), the mean PISQ-12 short form score improved from 10.50 ($SD = 4.02$) to 13.31 ($SD = 2.21$), with a mean difference of -2.81 ($SD = 3.71$), which was statistically significant, $t(15) = -3.033, p = 0.008$. In the HRT

group ($n = 11$), the mean score increased from 8.91 (SD = 5.61) to 11.73 (SD = 4.78), with a similar mean difference of -2.82 (SD = 6.06), though this change did not reach statistical significance, $t(10) = -1.542$, $p = 0.154$ (Table 3).

These findings suggest that vaginal laser therapy was associated with improved sexual quality of life across the entire cohort, with statistically significant improvements observed particularly in those who had not received hormone therapy in the past year.

Improvement in Sexual satisfaction VAS Score

Longitudinal changes in Sexual Satisfaction VAS Scores were evaluated using repeated-measures ANOVA across four time points: prior to treatment, three months after the initiation of treatment (i.e., upon completion of all three vaginal laser sessions), six months after treatment initiation, and one year after treatment initiation. Scores at follow-up were obtained through structured telephone interviews with the participants. At the one-year assessment, 6 women were lost to follow-up, resulting in a final analytic sample of 9 in the HRT group and 12 in the non-HRT group.

Table 2: Baseline characteristics of study participants

	HRT(Y) (n=11)	HRT(N) (n=16)	p-value
Age Mean (SD)	55.82 (5.17)	55.94 (6.36)	0.96
BMI Mean (SD)	22.22 (2.52)	23.33 (4.32)	0.41
Gravidity Mean (SD)	1.36 (1.12)	1.50 (0.73)	0.70

Baseline demographic and clinical characteristics of participants stratified by recent HRT exposure.

Table 3: Improvement in PISQ-12 short form scores before and after treatment

	Number of participants	Pre-treatment Mean (SD)	Post-treatment Mean (SD)	Mean Difference (SD)	p-value
Total	27	9.85 (4.70)	12.67 (3.50)	2.81 (3.62)	0.004
HRT(Y)	11	8.91 (5.61)	11.73 (4.78)	2.82 (6.06)	0.154
HRT(N)	16	10.50 (4.02)	13.31 (2.21)	2.81 (3.71)	0.008

Comparison of PISQ-12 short form scores before and after vaginal laser therapy, stratified by recent HRT exposure.

Table 4: Longitudinal changes in Sexual Satisfaction VAS scores

	Pre-treatment Mean (SE)	Post-treatment (3m after initiation) Mean (SE)	Post-treatment (6m after initiation) Mean (SE)	Post-treatment (1y after initiation) Mean (SE)	p-value	Post-hoc
HRT(Y) (n=9)	3.11 (0.59)	5.22 (0.74)	4.44 (0.67)	4.56 (0.80)	0.24	-
HRT(N) (n=12)	3.83 (0.42)	6.33 (0.54)	7.08 (0.63)	6.33 (0.60)	<0.001	Post>pre (p= 0.005) 6m>pre (p= 0.007) 12m>pre (p=0.001)

Mean Sexual Satisfaction VAS score at baseline, 3, 6, and 12 months following vaginal laser therapy, stratified by HRT exposure.

in vaginal pain, burning, itching, dryness, dyspareunia, and overall sexual function at 3 months, and these gains remained statistically significant at the 1-year follow-up, with patients maintaining comfort with vaginal dilators and expressing high satisfaction rates (~92%). Similarly, Schachar et al., conducted a prospective CO₂ laser study in a cohort of postmenopausal women, observing sustained significant improvements in both subjective assessments (e.g., VAS-VA, SAVQ, mVSQ, PISQ-12) and objective indices (Bachmann Vaginal Health Index and Vaginal Health Assessment) from baseline through one year after treatment completion. Moreover, histological evaluation in that study revealed evidence of neovascularization without worsening of epithelial atrophy, supporting both the efficacy and histologic safety of laser treatment over the long term [11].

The mechanisms of action of vaginal laser therapy and HRT are fundamentally different, which may be one of the reasons for the observed differences in treatment response. Vaginal laser therapy primarily promotes mucosal tissue remodeling through minimally invasive photothermal effects, leading to epithelial thickening, neovascularization, and collagen neosynthesis, thereby enhancing mucosal elasticity, hydration, and thickness. Histological studies have demonstrated that, following treatment, the number of epithelial cell layers increases, glycogen content is enhanced, and connective tissue papillae and neovascularization are observed [12]. In contrast, the therapeutic effects of HRT are mainly mediated through estrogen receptor-dependent pathways, which promote epithelial cell proliferation, increase vascular density and hydration, and improve mucosal metabolism and structural integrity. Evidence indicates that local vaginal estrogen therapy can restore vaginal pH to the acidic range typical of the reproductive years, stimulate epithelial maturation with glycogen-rich superficial cells, and enhance vaginal blood flow, elasticity, and lubrication, thereby alleviating GSM symptoms such as dryness and dyspareunia [13,14].

Due to these mechanistic differences, patients who have already received HRT may have mucosa in a relatively more optimal baseline condition, thereby limiting the additional tissue restoration achievable through laser therapy. This pattern was evident in our study, where the HRT group showed numerical improvement after treatment but did not reach statistical significance, suggesting a possible ceiling effect. Previous research has also reported that when estrogen therapy has already optimized mucosal lubrication and elasticity, the incremental benefit of subsequent laser treatment in these specific domains may be limited [15].

Another possible factor influencing treatment outcomes is that patients who respond poorly to HRT may also derive limited benefit from vaginal laser therapy. Poor responsiveness of the vaginal mucosa, epithelial thickness, or blood flow to estrogen may reflect more advanced tissue degeneration, thereby reducing responsiveness to non-hormonal treatments such as laser therapy. Potential mechanisms include decreased estrogen receptor sensitivity (e.g., with advanced age or prolonged postmenopausal status), severe tissue atrophy with limited repair capacity, and chronic inflammation or altered immune status. The literature also supports the importance of baseline tissue status in determining treatment response. Sokol et al. [10], reported that while laser therapy is effective for moderate-to-severe GSM, its benefits are limited in women with very severe symptoms or those unresponsive to other treatments. Portman et al. [16] similarly emphasized that individual factors such as age, medical history, and tissue characteristics influence treatment outcomes. As our study classified participants only by whether they had used HRT in the past year, without data on actual clinical response, type, duration, or continuity of HRT use, we could not directly confirm this hypothesis.

The strength of this study lies in the use of a standardized treatment protocol, as all patients underwent vaginal laser therapy using the same SmartXide² Laser System. This minimized variability associated with different devices and consumables. Additionally, the data were derived exclusively from local Taiwanese patients, which reduced potential confounding factors related to ethnicity and lifestyle, and enhanced the applicability of the findings to the local population.

However, several limitations should be noted. First, this was a single-center study with a relatively small sample size, and it focused exclusively on postmenopausal women, which may limit the generalizability of the results.

Second, the study did not further analyze the specific types or duration of hormone therapy used, which may have influenced the treatment response in the subgroup analysis. Third, sexual quality of life was assessed using self-reported questionnaires, which may be subject to response bias. Lastly, only short-term outcomes were evaluated; thus, the long-term efficacy and safety of vaginal laser therapy remain to be established.

CONCLUSION

This study demonstrated that fractional CO₂ vaginal laser therapy significantly improved sexual quality of life in postmenopausal women with genitourinary syndrome

of menopause (GSM). Improvements were observed in both PISQ-12 short form and Sexual Satisfaction VAS scores, with more consistent and sustained benefits in women without recent hormone replacement therapy (HRT) exposure. These findings suggest that vaginal laser therapy may be a valuable non-hormonal therapeutic option, particularly for patients who are unsuitable for or unresponsive to HRT. Nevertheless, the retrospective design, single-center setting, small sample size, and limited follow-up period constrain the generalizability of the results. Larger multicenter prospective studies with longer follow-up are warranted to confirm the long-term efficacy and safety of this modality.

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