



Original Research

Use of Er:YAG laser in the treatment of vulvar lichen sclerosus

Matilde Gómez-Frieiro, MD^{*}, Elena Laynez-Herrero, MD

Gabinete Médico Ginecológico, Santa Cruz de Tenerife, Spain



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ABSTRACT

Objective: The aim of this research was to evaluate the efficacy and safety of Er:YAG lasers to improve signs and symptoms of vulvar lichen sclerosus.

Methods: The study population consisted of 28 women with symptomatic vulvar lichen sclerosus. Three nonablative, thermal-only Er:YAG laser treatment sessions (7 J/cm², 2 Hz, 7 mm spot) were performed at 4-week intervals. Each patient was asked about the presence of symptoms, such as itching, pain, and coital pain. Clinical diagnosis was established on the basis of the presence of lesions such as hypopigmentation, ecchymosis, hyperkeratosis, excoriations, or fissures. The affected areas were divided by zones (clitoris, introitus, labia minora, labia majora, perineum, labial fusion, and effacement) and were visually evaluated. Based on the presence of symptoms, lesions, and affected zones, a scale with a maximum of 14 scores was established for use before and after treatment. The impact of lichen sclerosus on patients' lives before and after treatment was evaluated with an 11-point visual analogue scale, and treatment discomfort was assessed at each session.

Results: After analysis of each scoring component, individual statistically significant reductions were observed in itching, pain, ecchymosis, excoriations, and hypopigmentation.

Conclusion: The Er:YAG laser is a safe, well tolerated, and effective method for the adjuvant treatment of vulvar lichen sclerosus. Three sessions with monthly intervals using the indicated parameters can quantifiably reduce the impact of lichen sclerosus on patients' lives.

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Introduction

Vulvar lichen sclerosus is a chronic inflammatory dermatologic disease of autoimmune origin that is characterized by a lymphocytic response with a predilection for the skin of the genital area. It can affect both sexes and has an association with different autoimmune diseases (Murphy, 2010). Although vulvar lichen sclerosus can manifest extra-genitally, in women, the disease appears predominantly in the vulvar area. According to age distribution, vulvar lichen sclerosus is more frequent around the sixth decade of life. Symptoms and signs include itching, dryness, and irritation; consequently, the genital/sexual sphere of patients is affected by the appearance of dysuria and coital pain (Guerra, 2010). Histologically, the disease is characterized by epidermal atrophy, hyperkeratosis, follicular plugging, degeneration of the basal layer, and a band of subepidermal hyalinization of collagen in the papillary dermis above a lymphocytic infiltrate (Pérez-López and Vieira-Baptista, 2017).

The current first-line treatment of lichen sclerosus is symptomatic, aimed at palliating symptoms and delaying the recurrence of lesions (Neill et al., 2010). The effectiveness of topical clobetasol in improving the symptoms of lichen sclerosus has been demonstrated by chronic application with rest periods (Diakomanolis et al., 2002). However, the long-term use of high-potency corticosteroids can lead to skin thinning (Renaud-Vilmer et al., 2004). This has led to the search for alternative therapies, often aimed at being complementary treatments to corticosteroids. Drugs such as calcineurin inhibitors already have their place in the therapy of lichen sclerosus. Other techniques, such as the use of the CO₂ lasers, are justified by the repair effect of the lesion area after creating an ablative effect on the skin by stimulating the affected tissue from the adjacent edge in the subsequent healing (Baggish, 2016; Fillmer et al., 2009; Kartamaa and Reitamo, 1997; Lee et al., 2016). The application of platelet-rich plasma (Behnia-Willison et al., 2016) and the transfer of autologous fat (Onesti et al., 2016; Tonnard et al., 2013) are other alternatives to this treatment within the regenerative therapy group.

The use of lasers in gynecology has been investigated for more than 50 years, with the application of this technique to treat cervical and vaginal pathology and even pelvic pathology and fertility.

^{*} Corresponding Author.

E-mail address: matildegomez@gamegin.es (M. Gómez-Frieiro).

In recent years, the application of energy to the vaginal walls in a controlled manner has been observed to stimulate neovascularization, the proliferation of glycogen, and the formation of collagen in the lamina propria, which leads to an increase in natural lubrication and basal tone and thereby improves urinary incontinence and vaginal hypermobility by improving the biomechanical conditions of the vaginal mucosa (Gambacciani and Cervigni, 2015; 2017; Gambacciani and Levancini, 2015; Gaspar and Brandi, 2017; Gaspar et al., 2017; Jung et al., 2015; Lee, 2014; Vizintin et al., 2015). There are published reports about the benefits of non-ablative Erbium lasers in the treatment of vaginal relaxation syndrome (Lee, 2014), mild-to-moderate stress urinary incontinence (Gaspar and Brandi, 2017; Vizintin et al., 2015), and the genitourinary syndrome of menopause (Gambacciani and Cervigni, 2015; Gambacciani and Levancini, 2015, 2017; Gaspar et al., 2017). The Er:YAG laser with specific nonablative modality, which causes shrinkage of collagen fibers and consequently triggers neocollagenesis, might be another therapeutic option for lichen sclerosis, where an alteration in the distribution of collagen is very important (Drnovsek-Olup et al., 2004; Farkas et al., 2010; Lins et al., 2010; Pereira et al., 2002; Poon et al., 2005; Schmitt et al., 2017).

The indicated nonablative application of the Er:YAG laser lasts for 250 milliseconds and consists of a fast sequence of ultra-short pulses of 300 microseconds with intervals of 50 milliseconds. In this way, the temperature in the mucosa can be increased between 60° and 65° C without inducing superficial ablation. At this temperature, collagen is denatured, which creates short collagen fibers that function as a stimulus of fibroblasts; neocollagenesis begins to occur and happens within a maximum of 6 weeks. The activation of procollagen I and III, interleukin 1-beta, tumor necrosis factor alpha, tumor necrosis factor beta-1, and metalloproteinases has been shown to explain this effect in low-dose lasers (Drnovsek-Olup et al., 2004; Farkas et al., 2010; Lins et al., 2010; Pereira et al., 2002; Poon et al., 2005; Schmitt et al., 2017).

The aim of this study is to evaluate the effect of Er:YAG laser application on the impact of lichen sclerosis on the lives of women diagnosed with vulvar lichen sclerosis, assessing parameters such as extension, symptoms, clinical signs, scale of impact on life, and tolerance to treatment.

Methods

Patients

A total of 28 patients with a clinically confirmed diagnosis of vulvar lichen sclerosis were recruited from a gynecology clinic in Santa Cruz de Tenerife (Gabinete Médico Ginecológico), a private practice with a database of 23,500 patients at present. Diagnoses were not histologically confirmed. The study protocol was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all patients. The inclusion criteria included women age > 18 years who were diagnosed with vulvar lichen sclerosis; did not have problems with writing, reading, or verbal comprehension; and had provided written informed consent. The exclusion criteria included women with contraindications for the use of laser on the skin, those who did not sign informed consent, or had no clear diagnosis of vulvar pathology.

At the first visit, a clinical history was obtained and any other pathology and contraindication ruled out. Each patient was asked about the presence of symptoms such as itching, pain, and coital pain, and all positive responses were assigned a score of one point. The presence of clinical signs such as hypopigmentation, ecchymosis, hyperkeratosis, excoriations, or fissures were observed and given one point if present. The affected areas were divided by zones (clitoris, introitus, labia minora, labia majora, and perineum),

and a point was assigned to each affected zone. A photograph was taken before treatment, and the affected area was confirmed if there was effacement or labial fusion. A summary of the symptoms and clinical findings established a score that ranged from 0 (minimal effect) to 14 points (maximum effect). A visual analogue scale was used to assess the impact of lichen sclerosis on patients' lives, with 0 being no impact and 10 the maximum impact.

Laser treatment

First, the affected area was anesthetized with Emla anesthetic cream (lidocaine 25 mg/g + prilocaine 25 mg/g). In the first session, the Er:YAG laser (SP Dynamis, Fotona, Slovenia) was applied with a PS03 handpiece with fluence of 7 J/cm², 2 Hz, and spot of 7 mm in continuous application, making several passes that exceed the limits of the affected area. A special Er:YAG treatment modality (Fotona SMOOTH mode) that causes gentle coagulative heating of the skin was used. The modality delivers laser energy onto the skin in a fast sequence of low-fluence laser pulses inside an overall super-long pulse of 200 ms to 350 ms. Every so often when the area whitened, it was cleaned with gauze soaked in physiologic fluid. The objective was to achieve uniform whitening and an increase in local heat until erythema of the area or whitening was observed after 10 minutes of application. Three sessions were applied in monthly intervals. After each session, the patient was instructed to use Palomacare vulvar gel, an external moisturizer with hyaluronic acid, Asiatic spark, bioecolia (alpha aminoglucan), and aloe vera, for 3 days after treatment to calm possible discomfort in the area.

After the procedure, patient tolerance to the treatment was assessed via a questionnaire with four options (i.e., very tolerable, tolerable, slightly tolerable, and unacceptable). One month after the last session, the patient was summoned for a final survey and documentary verification by means of a photograph of the treated area, which was added to the database.

Statistical evaluation

All data were collected through the public domain program EPI INFO, which was designed by the Centers for Disease Control and Prevention of Atlanta and allows building databases and analyzing them for epidemiological studies. Means and standard deviations were calculated to describe the quantitative variables, and medians were measured to describe the variables deemed not normal according to the Kolmogorov-Smirnov test. For the comparison of scales, the nonparametric Wilcoxon test was performed, and the McNemar's test was used to compare each parameter of the total score before and after treatment. A *p*-value of < .05 was considered significant. The analyses were done with SPSS version 24.

Results

The average age of patients was 58.4 years (range: 29–78 years). Twenty-six of 28 patients had previously been pregnant, and 23 patients were menopausal. Twenty-two of 28 patients maintained regular sexual activity, and 6 patients did not have sexual relations due to the discomfort of their pathology. With regard to previous treatments with corticosteroids, 23 of 28 patients reported having had treatment on occasion, and 5 patients had never received treatment. Patients who had received corticosteroids suspended treatment a month before initiating Erbium laser treatment and did not resume treatment until 1 month after the last Erbium laser treatment, when the final assessment was made. Patients who had never received corticosteroid treatment were either never treated

until they reached the office and had not been diagnosed or did not want to take corticosteroid agents.

The total score assigned to each patient before treatment ranged from a minimum of 5 to a maximum of 14 (Fig. 1). The mean value was 9.3 with a standard deviation of 2.51. One month after the end of the three scheduled sessions, the score ranged from a minimum of 0 to a maximum of 10, with a mean value of 4.36 (standard deviation: 2.34; Fig. 1). The most frequent symptom before treatment was itching (82.1% of patients), pain (60.7%), and coital pain (50.0%). After-treatment itching was present in 14.3%, pain in 3.6%, and coital pain in 25.0% of patients (Fig. 2).

The mean visual analogue scale score of the impact of lichen sclerosis on patients' lives and the mean values of the total score decreased significantly after treatment (Table 1). Tolerance to treatment varied between very tolerable (57.14%), tolerable (35.71%), slightly tolerable (7.14%), or unacceptable (0%).

Statistically significant differences from before to after treatment were observed with symptoms such as itching and vulvar pain, but not coital pain, although a relationship between coital pain and a higher final score was found (Table 2). The following clinical signs showed statistically significant improvement after treatment: ecchymosis, excoriations, and hypopigmentation. Although some improvement in labial fusion and hyperkeratosis was detected, the improvement was not statistically significant. No improvement was seen in effacement (Figs. 3 and 4).

Table 1

Comparison of impact of lichen sclerosis on patients' lives and total score before and after treatment

	Mean (Standard deviation)	Median	p-value
Impact before treatment	5.36 (2.25)	5.5	< .0001
Impact after treatment	1.57 (1.4)	2	
Total score before treatment	9.32 (2.51)	10	< .0001
Total score after treatment	4.36 (2.34)	4	

The impact of lichen sclerosis on patients' life before and after treatment was assessed with a 0 to 10 visual analogue scale. The minimum value before treatment was 2 and the maximum was 10. After treatment the minimum was 0 and the maximum was 6. Contrast by Wilcoxon test.

Table 2

Comparison by component of total score before and after Er:YAG treatment

		Before	After	p-value
Itching	No	5	24	< .0001
	Yes	23	4	
Vulvar pain	No	11	27	< .0001
	Yes	17	1	
Coital pain	No	12	21	.146
	Yes	13	7	
Hypopigmentation	No	2	12	.006
	Yes	26	16	
Ecchymosis	No	8	23	< .0001
	Yes	20	5	
Hyperkeratosis	No	21	23	.625
	Yes	7	5	
Excoriations	No	11	24	.001
	Yes	17	4	
Introitus	No	1	10	.004
	Yes	27	18	
Labia minora	No	3	11	.008
	Yes	25	17	
Clitoris	No	5	11	.002
	Yes	23	17	
Labia majora	No	11	22	.001
	Yes	17	6	
Perineum	No	2	16	.001
	Yes	24	12	
Labial fusion	No	20	23	.375
	Yes	8	5	
Effacement	No	17	17	.999
	Yes	11	11	

There are significant differences [p < .05] for all parameters with the exception of coital pain, hyperkeratosis, presence of labial fusion, and effacement. Contrast with McNemar's test.

Discussion

To our knowledge, no report of Erbium laser treatment for vulvar lichen sclerosis has been published to date, except for a case report that describes the application of fractional laser on extragenital lichen sclerosis (Mendieta-Eckert et al., 2017) and a letter on two cases with hyperkeratotic lichen sclerosis treated with fractionally ablative Erbium laser (Hobson et al., 2019). In the case of extragenital lichen sclerosis, the patient showed no symptoms and clinical response even after 2 years of follow up.

The results of this study showed that Er:YAG laser treatment significantly reduces symptoms of lichen sclerosis such as itching and vulvar pain, but not coital pain. Improvement after treatment was significant in clinical signs (ecchymosis, excoriations, and hypopigmentation), and some improvement was detected in labial fusion and hyperkeratosis. No improvement was observed in effacement. Laser treatment was well tolerated by patients and significantly reduced the impact of lichen sclerosis on patients' lives.

Some limitations of the study include the lack of a control group, the possibility of a placebo effect, and the subjective assessment of symptoms (e.g., itching, pain, and coital pain) because

Total score of symptoms and clinical findings

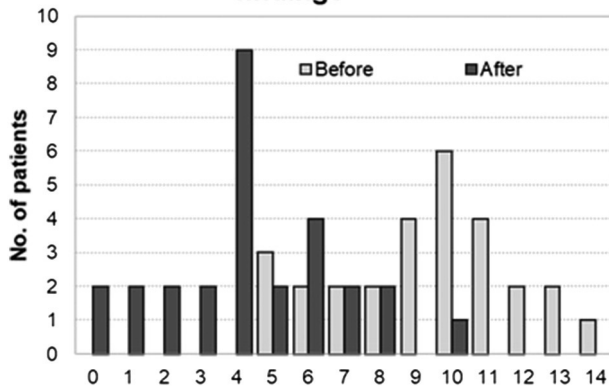


Fig. 1. Total score for the presence of symptoms, clinical signs, and affected areas before treatment and 1 month after the last treatment session.

Symptoms

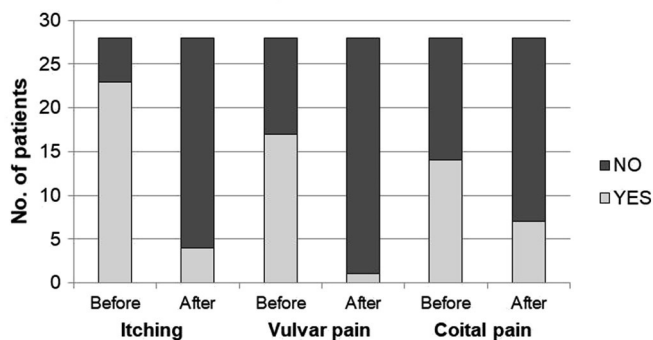


Fig. 2. Symptoms frequency before and after treatment.



Fig. 3. Reduction of white lesions on the sides of the introitus before (left) and after (right) treatment.



Fig. 4. Improvement in skin quality before (left) and after (right) treatment.

these depend on assessment by the patient and the other 11 parameters depend on assessment by the attending physician. Also, the initially striking results of a reduction in impact of lichen sclerosus on patients' lives can be attributed to patient bias because this was not a double-blinded study and may have involved a desire to collaborate with the doctor. Additionally, histology could also benefit the confirmation of a clinical diagnosis, but its inclusion in an adult lichen sclerosus severity scale is ques-

tionable (Sheinis and Selk, 2017). Analyzing biopsy test result changes to treatment may be objective, but whether this outcome is important to patients is unclear and likely should be used as an adjunct to other measures (Sheinis and Selk, 2017).

In addition, some patients may have associated genitourinary syndrome of menopause along with lichen sclerosus, but that was not a factor of exclusion in this study. Per our protocol, we did not treat the vagina but only the vulvar area, and the treatment

of genitourinary syndrome of menopause was not expected. For patients who responded to both pathologies, any improvement amounted to an additional benefit of treatment. Future work should consider what energy dose is the most effective; in our study we started from a choice based on tolerability by the patient and response to these fluences in other benign cutaneous pathologies, such as atrophy, scars, or stretch marks. The number of sessions applied and the intervals required to obtain the best results should also be considered. Further controlled clinical studies with larger sample sizes and longer follow-up are necessary to confirm the preliminary results of the effectiveness of Er:YAG laser treatment of this pilot study and provide standardization of parameters.

Conclusion

The Er:YAG laser is a good method for treatment of vulvar lichen sclerosis supplementary to topical steroids. Three sessions with monthly intervals with the indicated parameters provided a quantified reduction in the impact of lichen sclerosis on patients' lives. Most patients in this study had previously used topical corticosteroids, and treatment with the Er:YAG laser additionally reduced symptoms and clinical signs. Unifying criteria and description of the treatment guidelines for the specific lasers applied are important to obtain consistent results and improve the quality of future studies.

The Er:YAG laser opens a very interesting field in the regenerative treatment of chronic pathologies, and we encourage doctors who have this technology to use it as a complementary and safe alternative that has proven effective in reducing the impact of lichen sclerosis on a woman's life.

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Conflict of Interest

None.

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Study Approval

NA.

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