pISSN 0898-5901 | eISSN 1884-7269
Indexed in Scopus

Volume 33 - N. 1

Tumescent-assisted interstitial (intradermal/subcutaneous) 1470 nm diode laser treatment for primary axillary hyperhidrosis: a prospective single-center series of 23 cases with 12-month follow-up

Luigi Mazzi

Independent Researcher; Plastic Surgeon, Verona, Italy

ABSTRACT

Primary axillary hyperhidrosis (AH) is a chronic condition that significantly impacts quality of life. The 1470 nm wavelength, characterized by high hydro-absorption, offers the potential for more confined photothermocoagulation of the glandular compartment when energy is delivered interstitially under tumescent anesthesia. We conducted an uncontrolled single-center prospective series on 23 adults (16 men, 7 women; aged 21-53 years) treated using a 1470 nm diode laser (LASEmaR 1500®, Eufoton®, Trieste, Italy) connected to a 400 µm optical fiber inserted into a hollow cannula with an open tip and blunt end through 2-3 access points per axilla. Follow-up was carried out at 6 and 12 months. Outcomes included Hyperhidrosis Disease Severity Scale (HDSS; primary endpoint), gravimetry (mg/5 min), local humidity (%), Dermatology Life Quality Index (DLQI), Global Aesthetic Improvement Scale (GAIS), and safety. The protocol allowed selective retreatment at 6 months in patients with clinically relevant residual activity/high functional demands. All patients achieved HDSS ≤2 at both 6 and 12 months. Mean gravimetry decreased from 128.8±27.7 to 38.4±10.8 and 32.0±9.4 mg/5 min; humidity from 75.3±5.8% to 45.7±3.3% and 43.4±3.6%. DLQI fell from 15.9±4.4 to 5.0±1.1 and 4.3±1.1. At 12 months, overall assessment was excellent in 82.6% (19/23), good in 8.7% (2/23), and fair in 8.7% (2/23). Adverse events were mild and transient, with no infections or burns. Of the 23 participants, 16 underwent a single treatment session, while 7 received a retreatment at 6 months. In this prospective case series, interstitial 1470 nm laser with tumescent assistance was associated with clinically relevant improvement up to 12 months and a favorable tolerability profile. Given the uncontrolled observational design and selective retreatment in a subset, these findings should be considered hypothesis-generating and warrant confirmation in comparative studies.

Key words: axillary hyperhidrosis; 1470 nm laser; tumescent anesthesia; interstitial laser; clinical outcomes.

Corresponding author:
Luigi Mazzi, Via della Valverde 5, 37122 Verona, Italy.
E-mail: drluigimazzi@gmail.com

Received: 22 October 2025.
Accepted: 18 February 2026.

Laser Therapy

Licensee PAGEPress, Italy
Laser Therapy 2026; 33:429
doi:10.4081/ltj.2026.429

Introduction

Primary axillary hyperhidrosis (AH) is defined as excessive sweat production not intended for thermoregulation.[1,2] The condition, often beginning in youth, affects personal, social, and occupational spheres and entails a non-negligible psychosocial burden.[1,2]
Several therapeutic options are available, including topical agents and systemic anticholinergics, botulinum toxin injections, and procedural approaches such as microwave thermolysis or surgical/suction-curettage.[1,3-17] Each carries different profiles in terms of efficacy, durability, invasiveness, cost, and adverse events.[3-19]
Energy-based interstitial approaches aim to target the glandular layer while limiting damage to surrounding tissues.[2,20] The 1470 nm wavelength, due to its high absorption by water, can theoretically concentrate thermal effects within water-rich tissues and may allow more confined photothermal injury when energy is delivered interstitially. Combined with tumescent anesthesia, interstitial delivery may facilitate a stable treatment plane and potentially enhance procedural safety.[2,20] This single-center prospective series evaluates tumescent-assisted interstitial (intradermal/subcutaneous) 1470 nm diode laser treatment for primary axillary hyperhidrosis, with follow-up to 12 months using objective and validated patient-reported outcomes.

Materials and Methods

Study design and population

A consecutive prospective series was conducted on 23 adults with documented primary AH (Hyperhidrosis Disease Severity Scale [HDSS] 3-4; positive iodine-starch test). Patients with secondary hyperhidrosis, active local dermatoses, or contraindications to tumescent anesthesia or laser treatment were excluded. The cohort included 16 men and 7 women (aged 21-53 years). All participants provided informed consent.

Procedure (interstitial intradermal/subcutaneous technique)

Procedures were performed under tumescent anesthesia, introducing a 400 µm optical laser fiber into a hollow cannula (open tip, blunt end) through 2-3 access points per axilla. Interstitial passes were performed in the dermo-subcutaneous layer using a retrograde, fan-shaped pattern to ensure homogeneous coverage of the glandular plane. Energy delivery was guided by tactile/visual feedback and procedural recording; mean parameters per axilla were ~2200-2300 Joules, with tumescent volumes of ~90 mL and ~2.2 access points.
The laser device LASEmaR 1500® (Eufoton®, Trieste, Italy) was set with a pulse duration (time on) of 100 ms, a pause between pulses (time off) of 50 ms, and a power of 5 W.
The protocol provided for a single session as standard; 7 patients underwent retreatment at 6 months for clinically significant residual activity or high functional demands.

Tumescent anesthesia and infiltration technique

Tumescent assistance was used not only for analgesia but also to facilitate a controlled and reproducible treatment plan. The tumescence creates a temporary tissue separation ("tumescent cushion") that increases the distance from deeper neurovascular structures, stabilizes subdermal geometry, and may contribute to thermal confinement and more uniform energy delivery during interstitial laser application, thereby potentially improving both efficacy and safety.
The tumescent solution consisted of 500 mL of normal saline, 1% mepivacaine, one ampoule of epinephrine, and 10 mL of sodium bicarbonate. Infiltration was performed under sterile conditions using a fan-shaped technique to achieve uniform subdermal tumescence across the hyperhidrotic area until adequate tissue firmness and a homogeneous lifting of the skin were obtained. The intended infiltration plane was the dermo-subcutaneous junction, creating a consistent working space for the interstitial laser fiber. The mean infiltrated volume was approximately 90 mL per axilla, with minor adjustments based on axillary surface area and the clinical endpoints of uniform tumescence and blanching. Total infiltrated volume per axilla and infiltration endpoints (clinical tumescence and blanching) were recorded intraoperatively.

Outcome measures and follow-up

Assessments were performed at baseline, 6 months, and 12 months, with the primary endpoint being the HDSS and secondary endpoints including gravimetry (mg/5

min), local humidity (%), Dermatology Life Quality Index (DLQI), Global Aesthetic Improvement Scale (GAIS), and safety (local and systemic adverse events and complications). The combined use of objective and patient-reported indicators reflects the multidimensional nature of the disorder and enables correlation of sweat output reduction with perceived benefit.

GAIS methodology

GAIS was assessed as a patient-reported outcome at each follow-up visit (6 and 12 months), using the standard 5-point scale (–1 = worse, 0 = no change, 1 = improved, 2 = much improved, 3 = very much improved) with reference to the baseline condition. Because of the nature of the intervention, blinding was not feasible; however, GAIS was collected using a standardized script prior to completion of other questionnaires to minimize anchoring effects.

Statistical analysis

Continuous variables are expressed as mean ± standard deviation (SD) and 95% confidence interval (CI); proportions as percentages. Given the observational design without a comparator, analyses were descriptive, with an exploratory subgroup evaluation (one *vs.* two sessions) reported descriptively.

Table 1. Baseline characteristics.

Variable	Mean±SD (95% CI)
Gravimetry (mg/5 min)	128.8±27.7 (117.5-140.1)
Humidity (%)	75.3±5.8 (73.0-77.7)
DLQI	15.9±4.4 (14.1-17.7)

SD, standard deviation; CI, confidence interval; DLQI, Dermatology Life Quality Index.

Results

Baseline characteristics

Baseline severity was high (HDSS 4 in 78.3%; HDSS 3 in 21.7%). Objective and DLQI baseline values are reported in Table 1.

Clinical efficacy (overall)

Symptom control was broad and consistent: all patients achieved HDSS ≤2 at 6 and 12 months. Sweat output (gravimetry) was reduced to 38.4±10.8 mg/5 min at 6 months (–70.2% *vs.* baseline) and to 32.0±9.4 mg/5 min at 12 months (–75.2% *vs.* baseline); local humidity decreased to 45.7±3.3% and 43.4±3.6%, while DLQI improved to 5.0±1.1 and 4.3±1.1 (Table 2).
At 12 months, global evaluation rated outcomes as excellent in 82.6% (19/23), good in 8.7% (2/23), and fair in 8.7% (2/23). Among the 7 patients who were retreated at 6 months, the sustained benefit at 12 months should be interpreted in the context of the adopted procedural strategy (see the *Exploratory subgroup analysis* and *Discussion* sections).

Exploratory subgroup analysis (one vs. two sessions)

Sixteen of 23 patients (69.6%) underwent a single treatment session, while 7/23 (30.4%) underwent a second ses-

Table 2. Main outcomes (6 and 12 months).

Endpoint	6 months	12 months
HDSS responders (≤2)	23/23 (100%)	23/23 (100%)
Gravimetry (mg/5 min), mean±SD (95% CI)	38.4±10.8 (34.0-42.8)	32.0±9.4 (28.2-35.8)
Humidity (%), mean±SD (95% CI)	45.7±3.3 (44.4-47.1)	43.4±3.6 (42.0-44.9)
DLQI, mean±SD (95% CI)	5.0±1.1 (4.6-5.5)	4.3±1.1 (3.9-4.8)
GAIS overall assessment	–	Excellent: 82.6% (19/23) Good: 8.7% (2/23) Fair: 8.7% (2/23)

HDSS, Hyperhidrosis Disease Severity Scale; SD, standard deviation; CI, confidence interval; DLQI, Dermatology Life Quality Index; GAIS, Global Aesthetic Improvement Scale.

sion at 6 months due to residual symptoms/high functional demands. At 12 months, outcomes were comparable between the two subgroups, consistent with the interpretation that selective retreatment largely equalized the response trajectory in those with incomplete initial improvement. Gravimetry at 12 months was 31.8±8.6 mg/5 min in the one-session group and 32.4±9.4 mg/5 min in the two-session group; DLQI at 12 months was 4.25±1.06 and 4.40±1.13, respectively (Table 3). Given the non-randomized nature of retreatment selection and the limited subgroup size, these findings are presented descriptively and should be interpreted as hypothesis-generating.

Safety

The tolerability profile was favorable. Reported events – mild/transient pain in all cases (expected), ecchymosis 47.8%, edema 30.4%, transient paresthesia 17.4%, and transient dyschromia 2.7% –resolved spontaneously or with conservative measures. No infections or burns were documented (Table 4). No retreatments were required due to complications.

Procedural parameters

The interstitial technique employed a 400 µm fiber with fan-shaped and retrograde trajectories under tumescent anesthesia, maximizing thermal selectivity and surface protection. Mean procedural parameters and device use are shown in Table 5. The indication for a second session in 7/23 patients reflects a strategy of personalized adjustment according to clinical response.

Discussion

Findings from this prospective series suggest that tumescent-assisted interstitial (intradermal/subcutaneous) 1470 nm diode laser treatment is associated with consistent improvement in primary axillary hyperhidrosis through 12 months, with coherence between objective indices (gravimetry, humidity) and patient-reported outcomes (HDSS, DLQI, GAIS). Given the uncontrolled observational design and modest sample size, these findings should be interpreted cautiously and considered hypothesis-generating rather than confirmatory.

Three considerations are relevant. First, consistency of benefit: marked reductions in sweat output were paralleled by improvements in symptom severity and quality of life, supporting meaningful clinical impact. Second, durability should be interpreted in a procedural context: approximately 30% of patients underwent a second session at 6 months; therefore, 12-month outcomes reflect an individualized treatment course rather than a uniform

Table 3. Exploratory subgroup outcomes at 12 months by number of sessions.

Outcome (12 months)	One session (n=16) Mean±SD	Two sessions (n=7) Mean±SD
Gravimetry (mg/5 min)	31.8±8.6	32.4±9.4
DLQI	4.25±1.06	4.40±1.13

SD, standard deviation; DLQI, Dermatology Life Quality Index.

Table 4. Adverse events (n=23).

Adverse event	n	%
Mild/transient pain	23	100.0
Ecchymosis	11	47.8
Edema	7	30.4
Transient paresthesia	4	17.4
Transient dyschromia	2	2.7
Infection	0	0.0
Burn	0	0.0

Table 5. Procedural parameters.

Variable	Mean±SD
Energy per axilla – right (kJ)	2.22±0.28
Energy per axilla – left (kJ)	2.24±0.28
Tumescent volume – right (mL)	88.3±9.0
Tumescent volume – left (mL)	88.5±16.2
Access points per axilla	2.2±0.4
Device	1470 nm diode laser (LASEmaR 1500®)
Number of sessions	1 session: 16/23 (69.6%); 2 sessions: 7/23 (30.4%)

SD, standard deviation.

single-session effect. In this cohort, the exploratory subgroup analysis showed similar 12-month gravimetry and DLQI between one-session and two-session groups, consistent with a "catch-up" effect of selective retreatment. However, causal inference is not possible without randomization. Third, thermal selectivity: owing to its high hydro-absorption, the 1470 nm wavelength may concentrate thermal injury within the glandular compartment while limiting exposure of adjacent tissues. Interstitial delivery, distancing the energy source from the epidermis and exploiting the tumescent cushion, likely contributes to the favorable tolerability profile observed.[2,20]

Methodological transparency regarding the tumescent solution and infiltration approach is important because tumescence may influence effective energy delivery and thermal spread during interstitial laser treatment. Therefore, the observed clinical improvements should be interpreted within the context of a combined procedural strategy (laser application with standardized tumescent assistance) rather than as the isolated effect of laser energy alone.[2,20]

From a practical standpoint, this technique may represent a minimally invasive option for selected patients seeking a longer-lasting approach than temporary therapies. However, comparative effectiveness against established options (*e.g.*, botulinum toxin, topical/systemic anticholinergics, microwave-based approaches, or surgical techniques) requires direct evaluation.[1,3-19]

Study limitations include the single-center observational design, absence of a comparator, and small sample size. These factors warrant caution in extrapolation and justify future controlled head-to-head studies, follow-up beyond 12 months, and inclusion of cost-utility analyses. Regarding presentation, several figures may duplicate tabulated data; consolidation of figures or replacement with a single figure illustrating subgroup outcomes (one *vs.* two sessions) could provide incremental interpretability.

Conclusions

In this prospective single-center case series, tumescent-assisted interstitial (intradermal/subcutaneous) 1470 nm diode laser treatment was associated with broad symptomatic improvement and a favorable tolerability profile through 12 months. Because the study is uncontrolled and a subset underwent selective retreatment at 6 months, conclusions on durability and positioning within therapeutic pathways should remain cautious. These results should be considered hypothesis-generating and require confirmation in comparative trials.

Conflict of interest

The author declares no conflict of interest.

Ethics approval and patient consent to participate

The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to treatment. Formal ethics committee approval was not required according to local regulations for this type of study.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

References

1. International Hyperhidrosis Society. Primary focal axillary hyperhidrosis (clinical guidance). 2018. Available from: https://www.sweathelp.org/treatments-hcp/clinical-guidelines/primary-focal-hyperhidrosis/primary-focal-axillary.html
2. Cervantes J, Perper M, Eber AE, et al. Laser treatment of primary axillary hyperhidrosis: a review of the literature. Lasers Med Sci 2018;33:675-81.
3. Lowe NJ, Yamauchi PS, Lask GP, et al. Botulinum toxin type A in primary axillary hyperhidrosis: a 52-week multicentre double-blind, randomised, placebo-controlled study. J Am Acad Dermatol 2007;56:604-11.
4. Grove GL, McHugh M, Rockenbach JS, et al. Botulinum toxin A versus microwave thermolysis for axillary hyperhidrosis: long-term side-by-side comparison. JAAD Int 2024 (ahead of print).
5. Glaser DA, Coleman WP III, Fan LK, et al. A randomised, blinded clinical evaluation of a novel microwave device for treating axillary hyperhidrosis. Dermatol Surg 2012;38:185-91.
6. Hong HCH, Lupin M, O'Shaughnessy KF. Clinical evaluation of a microwave device for treating axillary hyperhidrosis. Dermatol Surg 2012;38:728-35.
7. Kaminaka C, Yamamoto Y, Tsuboi R. Clinical and histological evaluation of a single high-energy microwave treatment for axillary hyperhidrosis and osmidrosis. Lasers Surg Med 2019;51:635-43.
8. Hsu TH, Chen YT, Tu YK, Li CN. A systematic review of microwave-based therapy for axillary hyperhidrosis. J Cosmet Laser Ther 2017;19:275-82.
9. Nasr MW, Jabbour SF, Haber RN, et al. Comparison of microwave ablation, botulinum toxin injection, and liposuction-curettage in the treatment of axillary hyperhidrosis: a systematic review. J Cosmet Laser Ther 2017;19:36-42.
10. NICE. Interventional procedures overview: Microwave thermolysis for primary axillary hyperhidrosis (IPG601). London: National Institute for Health and Care Excellence; 2017.
11. Roychowdhury S, Aslam R, Nip T. Microwave-based therapy for axillary hyperhidrosis: a review. Shanghai Chest 2019;3:19.
12. Pariser DM, Ballard A, Hebert AA, et al. Topical glycopyrronium tosylate for primary axillary hyperhidrosis: results from the ATMOS-1 and ATMOS-2 phase 3 RCTs. J Am Acad Dermatol 2019;80:128-38.e2.
13. Hebert AA, Glaser DA, Pieretti L, et al. Long-term efficacy and safety of topical glycopyrronium tosylate cloth 2.4%: 44-week open-label extension. Pediatr Dermatol 2020;37:711-8.
14. Kirsch B, Lohse J, Jackson J, et al. Efficacy and safety of topical sofpironium bromide gel for axillary hyperhidrosis: phase II randomised trial. J Am Acad Dermatol 2020;82:1150-8.
15. Yokozeki H, Abe M, Fujimoto T, et al. Phase 3 randomised study of 5% sofpironium bromide gel in Japanese patients with primary axillary hyperhidrosis. J Dermatol 2021;48:451-9.
16. International Hyperhidrosis Society. Sofpironium (SOFDRA) topical gel 12.45%: FDA approval update. 2024. Available from: https://www.sweathelp.org/treatments-hcp/sofdra-sofpironium-bromide-topical-gel.html
17. Grove GL, Kirtland S, Ballard A, et al. Impact of microwave thermolysis energy levels on patient-reported outcomes. Lasers Surg Med 2023;55:105-15.
18. Chang CK, Tung YC, Lin YT. Brachial plexus injury after microwave-based treatment for axillary hyperhidrosis and osmidrosis. J Cosmet Laser Ther 2017;19:439-41.
19. Puffer RC, Spinner RJ, Amrami KK, et al. Bilateral brachial plexus injury after microwave procedure for axillary hyperhidrosis: case report. World Neurosurg 2019;124:370-2.
20. Ibrahim DA, El-Basiouny MS, Elwakil TF, AboEitta MR. Diode laser 1470 nm versus diode laser 980 nm for treatment of primary axillary hyperhidrosis. Int J Curr Res Rev 2022;14:51-60.