



Folliculotropic mycosis fungoides of the face successfully treated combining CO₂ laser and conventional photodynamic therapy (c-PDT)

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ARTICLE INFO

Keywords:

Mycosis fungoides
Folliculotropic mycosis fungoides
FMF
CO₂ laser
Photodynamic therapy
PDT

ABSTRACT

A 57-year-old male with a three-year history of folliculotropic mycosis fungoides (FMF), previously treated systemically, received CO₂ laser-assisted photodynamic therapy (PDT) following the recurrence of FMF on the face. The procedure involved a CO₂ laser (SmartXide DOT Deka) and the photosensitizing agent methyl aminolevulinate (MAL) (METVIX 160 mg/g Cream, Galderma Medical), in conjunction with a red light-emitting diode lamp (Aktilite CL128, Galderma, wavelength 630 nm). The primary endpoint was the clinical remission of the lesions; the secondary one the evaluation of treatment tolerance, measured using the 11-point (0–10) Numeric Rating Scale (NRS) for burning/pain, heat, and swelling. After a single treatment session and four weeks of follow-up, the patient's facial lesions achieved complete clinical remission.

1. Case report

A 57-year-old male patient with a three year-history of folliculotropic mycosis fungoides (FMF) was treated with low-dose total skin electron beam therapy (TSEBT) for a progression to stage IIB disease. After three months of complete remission, the patient showed a relapse consisting in asymptomatic erythematous patches and thin plaques with keratotic follicular plugs located on the face [Fig. 1A]. At this stage, the patient refused any topical treatment. Therefore, given the restricted skin involvement and the delicate anatomical site, we opted for a laser-assisted photodynamic therapy.

The procedure involved a CO₂ laser (SmartXide DOT Deka) and the photosensitizing agent methyl aminolevulinate (MAL) (METVIX 160 mg/g Cream, Galderma Medical), in conjunction with a red light-emitting diode lamp (Aktilite CL128, Galderma, wavelength 630 nm). The primary endpoint was the clinical remission of the lesions, while the secondary one the evaluation of treatment tolerance, measured using the 11-point (0–10) Numeric Rating Scale (NRS) for burning/pain, heat, and swelling.

The procedure consisted of two sequential phases within the same treatment session: the CO₂ laser phase (LASER) and the conventional photodynamic therapy phase (PDT). Each phase included two procedural steps (A and B). During LASER-A phase, a vaporization of the follicular plugs composed of keratin/mucoid/sebaceous material was

performed using continuous emission with a pulse power of 3.7 W and a frequency of 5Hz. In LASER-B, we performed a fractional micro-ablative scan, with a spacing of 600 μm and a residence time of 700 μs. Afterwards, in PDT-A, MAL 16 % cream was applied under occlusion for three hours. In PDT-B, the patient's face was irradiated with a dosage of 37 J/cm² for eight minutes. At the end of the entire procedure, the patient exhibited facial redness and slight swelling. Pain was reported as the most intense sensation, with NRS rating of 6, followed by heat and swelling' sensation with an NRS rating of 5 and 3, respectively. After four weeks and one treatment session, clinically the patient's facial lesions were in complete remission [Fig. 1B].

2. Discussion

FMF is a distinct variant of mycosis fungoides (MF), accounting for about 5 % of the primary cutaneous T-cell lymphomas (CTCLs) [1]. Although numerous studies describe the successful use of photodynamic therapy (PDT) as skin-directed therapy in early-stage MF (up to stage IIA) [2,3], PDT has not yet been formally recommended as a primary treatment in MF [4]. However, complete cutaneous responses have been reported in >60 % MF plaque-type treated with conventional (c-)PDT [5]. Ablative fractional CO₂ laser could serve as a complementary tool to c-PDT in MF [6], potentially achieving complete clinical response with fewer treatment sessions. The use of fractional CO₂ laser as a *drug*

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Fig. 1. Folliculotropic mycosis fungoides of the face. Baseline (Fig. 1A) and four weeks after treatment (Fig. 1B).



Fig. 2. Sequential phases of CO2 laser-assisted photodynamic therapy

Baseline, facial erythematous patches with whitish millimetric follicular plugs (Fig. 2A); LASER-A phase, vaporization of follicular plugs using CO2 laser in continuous emission (Fig. 2B), LASER-B phase, fractional micro-ablative CO2 laser scan with spacing of 600 μm (Fig. 2C); PDT-A and B phase, application of methyl aminolevulinate cream (Fig. 2D), left under occlusion for 3 h and illuminated with a red light-emitting diode lamp; mild erythema and edema immediately afterwards CO2 laser + c-PDT session (Fig. 2E); After four weeks, complete clinical remission (Fig. 2F).

delivery method creates skin columns, allowing MAL to penetrate deeper into the dermis without negatively affecting the good tolerance of the procedure, as confirmed by our NRS evaluation. Indeed, c-PDT plus fractional CO2 laser can be a therapeutic option in MF patients for selected limited skin areas, such as the face. Otherwise, unlike using the lowest available energy [6], we believe that CO2 laser parameters should be calibrated to release sufficient thermal impulses able to induce moderate to moderate-severe tissue inflammation, enhancing PDT efficacy and respecting the patient's reported pain symptoms during the procedure. Theoretically, this combination may have a synergistic effect by inducing the apoptosis of neoplastic T cell and stimulating a reactive inflammatory infiltration against MF cells (Th1 shift), enhancing the chances of complete clinical response. No cases of FMF treated with CO2 laser-assisted PDT have been reported in literature to date.

In conclusion, CO2 laser-assisted photodynamic therapy seems to represent a promising alternative treatment for circumscribed FMF, particularly in delicate anatomical sites. Therefore, further comparative studies are needed to validate its methodology and efficacy.

Fundings

None

Ethics statement

The patients in this manuscript have given written informed consent to publication of their case details.

Data availability statement

The data support the findings of this study are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Biagio Scotti: Conceptualization, Data curation, Formal analysis, Visualization, Writing – original draft, Writing – review & editing, Investigation. **Bianca Maria Piraccini:** Resources, Writing – review & editing. **Alessandro Pileri:** Conceptualization, Supervision, Validation, Visualization, Writing – review & editing.

Declaration of competing interest

None.

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