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Line-field confocal optical coherence tomography for biopsy-site selection and treatment monitoring in plaque morphea

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Dear Editor,

Morphea (localized scleroderma) is a cutaneous inflammatory fibrosing disorder characterized by heterogeneous clinical presentation and variable disease activity. Although diagnosis is predominantly clinical, accurate assessment of activity can be challenging, particularly in plaque-type disease where inflammatory and sclerotic components coexist. Non-invasive imaging may support the identification of active disease areas and help guide correct clinical management.[1,2]

Line-field confocal optical coherence tomography (LC-OCT) is a non-invasive imaging technology that integrates the physical principle of optical coherence tomography with reflectance confocal microscopy, enabling real-time acquisition of vertical and horizontal skin sections with near-histologic resolution and a penetration depth of approximately 500 μm. It allows *in vivo* evaluation of epidermal and superficial dermal architecture, including fibrotic remodeling, inflammatory infiltrates, and vascular alterations.[3]

We report a case of plaque morphea in which LC-OCT was used to assess intralesional heterogeneity, guide biopsy-site selection, and evaluate early treatment response.

A 24-year-old woman presented to our clinic with a slightly depressed, infiltrated plaque on the right hypochondriac region, located in a friction-prone area beneath her clothing (Figure 1a). The lesion had been present for approximately 9 months. On clinical examination, it appeared as a centrally hyperpigmented plaque with a mildly erythematous peripheral border, overall suggestive of plaque-type morphea in its sclerotic stage. LC-OCT imaging of the central lesion demonstrated an intact epidermis and pronounced hyperreflective areas within the dermis, likely corresponding to thickened collagen bundles. Additionally, decreased vascularity and loss of adnexal structures were observed. In contrast, LC-OCT assessment of the lesion periphery revealed a preserved epidermis, focal hyperreflective regions surrounding superficial dermal vessels, and increased vascularity, indicative of ongoing inflammatory activity at the margin. On the basis of these LC-OCT findings, a peripheral portion of the lesion was selected as the most informative site for biopsy (Figure 1c). Histopathological examination showed a normal epidermis and a mild superficial perivascular inflammatory infiltrate, with scattered lymphocytes at the dermo-epidermal junction and focal vacuolar degeneration of basal keratinocytes (Figure 1b). The clinicopathological findings confirmed plaque-type morphea in the sclerotic stage. The patient was treated with an ultra-high-potency topical corticosteroid and re-evaluated after one month. Follow-up clinical examination revealed resolution of peripheral inflammation, with LC-OCT confirming clearance of subclinical perivascular inflammatory activity at the lesion border (Figure 1d).

Morphea remains primarily a clinical diagnosis; however, detection of disease activity may be

challenging when inflammatory alterations are subtle or only partially appreciable on examination. In this setting, non-invasive imaging techniques may provide complementary information to clinical assessment. In the case presented, LC-OCT documented distinct structural features between the central and peripheral portions of the lesion. As already observed, the central area showed findings consistent with sclerosis, including dermal hyperreflectivity, reduced vascularity, and adnexal loss.[4] An increased vascularity and focal perivascular hyperreflective changes were evident at the border of the lesion, suggesting ongoing inflammatory activity despite the overall sclerotic appearance of the plaque. This lesional heterogeneity led to a targeted biopsy site, hence improving the likelihood of sampling the most informative area. Moreover, a strict correlation between clinical response and peculiar LC-OCT findings was highlighted. Indeed, following topical steroid therapy, resolution of the subclinical peripheral inflammatory changes paralleled clinical improvement, suggesting that LC-OCT may be a valuable tool for monitoring subclinical disease activity over time. This is particularly relevant in morphea, where distinguishing between active and inactive disease stages may influence therapeutic decisions. Although conclusions cannot be drawn from a single case, our observation supports the potential role of LC-OCT as an adjunctive tool in plaque morphea. In particular, LC-OCT may be helpful in identifying lesional heterogeneity, selecting optimal biopsy sites, and monitoring therapeutic response beyond visible clinical changes.

This case suggests that LC-OCT may represent a valuable non-invasive adjunct in plaque morphea. Beyond enabling specific disease features like dermal sclerosis, it may help detect subclinical inflammatory activity, guide biopsy-site selection, and monitor treatment response. Larger studies are needed to assess the reproducibility of these findings and to better define the place of LC-OCT in the routine clinical practice.

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Figure 1. a) Clinical presentation. A slightly depressed, infiltrated plaque on the right hypochondriac region. **b**) Histopathology shows mild superficial perivascular inflammatory infiltrate, with some lymphocytes visible at the dermo-epidermal junction and focal vacuolar changes of basal keratinocytes (hematoxylin and eosin; magnification: 40x). **c**) LC-OCT at baseline. At the lesion border, LC-OCT showed a preserved epidermis, focal hyperreflective areas surrounding vessels in the upper dermis (red star), and increased vascularity (blue arrows). **d**) LC-OCT at 1-month follow-up. At the lesion border, LC OCT showed the absence of hyperreflective areas surrounding vessels and bundles of collagens after treatment (white arrow).