Use of pulsed dye laser in iron infusion-induced dermal haemosiderosis

Dear Editor,

Iron extravasation is an uncommon complication of intravenous iron therapy for anaemia, typically affecting women. Clinically, it manifests as a well-demarcated grey-brown macule that may persist indefinitely without treatment.[1] Management remains challenging, with laser therapy being the most frequently employed approach.[2] However, outcomes are variable, and no standardised protocol has been established.

A 67-year-old woman, a known case of hereditary haemorrhagic telangiectasia (Osler-Weber-Rendu disease), developed an asymptomatic brownish macule with well-defined borders, measuring approximately 15 cm in diameter, present on the medial aspect of the right arm following intravenous iron infusion for anaemia related to her underlying condition [Figure 1a]. A skin biopsy confirmed dermal haemosiderosis [Figures 1b and 1c]. She underwent 11 monthly sessions of pulsed dye laser (PDL) treatment, using a 0.5 ms pulse duration, 10 mm spot size and fluences progressively increased from 6.5 to 9.5 J/cm², with significant clinical improvement [Figures 2a and 2b]. No adverse effects were reported or observed during or after the treatment.

Iron extravasation results in dermal deposition of ferric compounds, usually ferric carboxymaltose, following leakage from the infusion site. Iron is deposited as haemosiderin in the deep dermis, where its spontaneous clearance is limited and topical therapies offer poor efficacy.[2,3] Laser treatment relies on the principle of selective photothermolysis, which disrupts pigment particles for removal through lymphatic and transepidermal pathways.[4] Q-switched lasers (ruby, Nd: YAG, alexandrite) have shown efficacy in reducing pigmentation, though complete clearance is not always achieved.[1]

Haemosiderin granules absorb light predominantly at 470-480 nm and 660-680 nm, while ferric oxide absorbs in the range of 300-400 nm.[3,4] The use of carriers like carboxymaltose or sucrose may shift peak absorption to 500-600 nm.[3] Theoretically, shorter wavelengths such as those of the Q-switched ruby (694 nm) and Q-switched-Nd: YAG (532 nm) lasers are more suitable, but these wavelengths offer limited dermal penetration, which may be insufficient to treat deeper pigment deposition.[4]

A combination of different wavelengths, as proposed by Eggenschwiler *et al*.[3] in a series of 13 patients, may improve outcomes. In their cohort, eight patients achieved

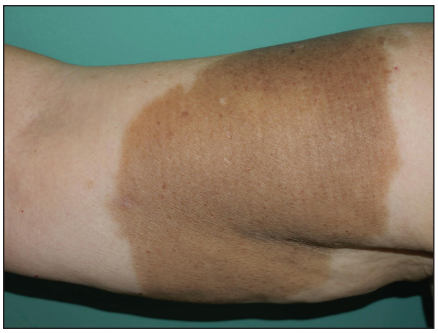

Figure 1a: Well-demarcated, brownish macule with uniform pigmentation on the medial aspect of the right arm.

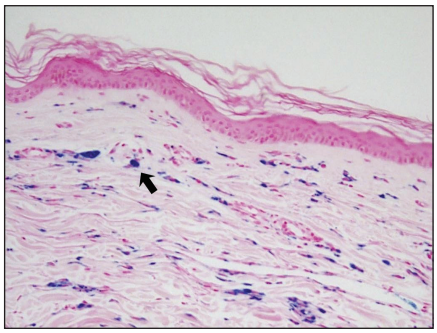

Figure 1b: Scattered blue-stained iron deposits (Black arrow) in the dermis, consistent with haemosiderin (Perls stain, 100x).

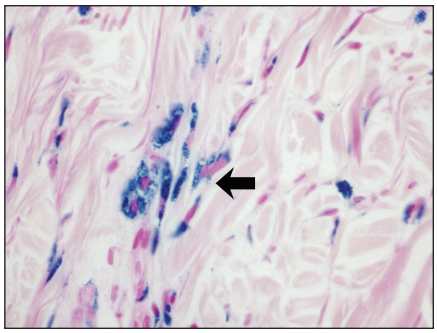

Figure 1c: Dense haemosiderin granules (Black arrow) present intracellularly within macrophages and extracellularly in the interstitial dermis (Perls stain, 400x).

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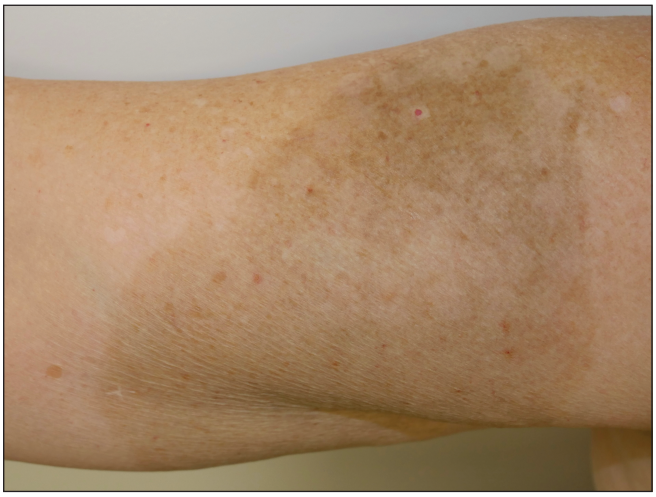

Figure 2a: Partial improvement after five pulsed dye laser sessions, with discrete round areas of lightening consistent with the laser spot distribution.

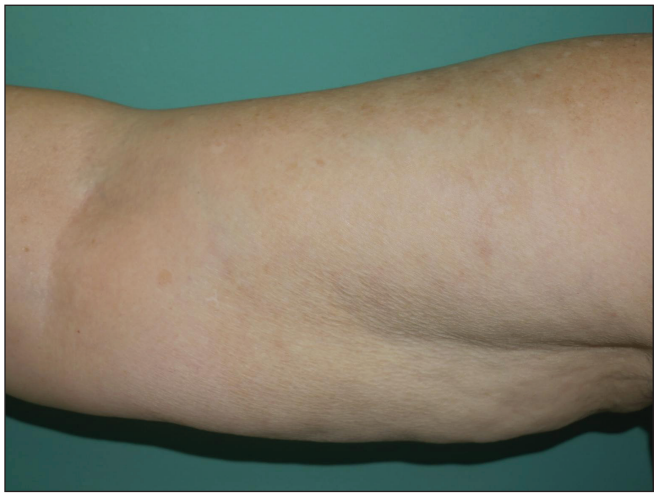

Figure 2b: Near-complete resolution of the haemosiderotic pigmentation after 11 sessions of pulsed dye laser treatment.

complete clearance, six of whom were treated with combined therapies (mostly Q-switched ruby and Nd:YAG) and two with picosecond lasers. However, the authors noted that due to the use of multiple devices and the variability of skin phototypes, no consistent superiority of combination therapy over monotherapy could be demonstrated.

PDL, which operates at 595 nm and targets oxyhaemoglobin through photothermal and photocoagulative effects, is more widely available than Q-switched or picosecond lasers, which are often limited to private or specialised settings. Although primarily used for vascular lesions, PDL has also demonstrated efficacy in conditions such as acne, rosacea and scars.[5] PDL has also been tried in lichen aureus and other inflammatory dermatoses, suggesting a potential anti-inflammatory effect, although evidence remains limited.[6] To our knowledge, its use in iron-induced hyperpigmentation has not been previously documented. Despite not matching haemosiderin absorption peaks, PDL may exert a therapeutic effect by coagulating vessels near iron deposits and addressing associated microhaemorrhages, thus improving pigmentation.[3]

In our case, a short pulse duration (0.5 ms) and progressive fluence adjustment yielded a gradual but marked improvement in pigmentation with no adverse effects. Spontaneous resolution of dermal haemosiderosis is rare and usually incomplete, even after prolonged periods. In our case, clinical improvement was progressive and fluence-dependent, and the clearing between sessions followed a spot-like distribution pattern consistent with the selective action of the laser, rather than spontaneous fading. This supports the potential utility of PDL in treating iron extravasation-related haemosiderosis.

Iron-induced dermal haemosiderosis remains a therapeutic challenge due to its chronicity, lack of standardised treatments and limited therapeutic options. PDL, not previously reported for this indication, may represent an accessible and effective alternative. Further comparative studies are needed to validate its role and help define evidence-based treatment protocols.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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