Fractional Photothermolysis for Treatment of Poikiloderma of Civatte

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Poikiloderma of Civatte refers to a change in the skin where there is atrophy, hyper- and hypopigmentation, and dilation of fine blood vessels (telangiectasia).¹,² These alterations often cause cosmetic disfigurement most commonly in middle-aged or elderly women with a fair complexion.¹,² Several treatment modalities, based on the theory of selective photothermolysis,³ including argon lasers, potassium titanyl phosphate (KTP) lasers, pulsed dye lasers, and intense pulsed light devices, have been used to treat this condition in the past.⁴–¹³ Clinical experience has shown that complete clearing is difficult to achieve. Moreover, depending on the modality used, adverse effects such as scarring with irregular hypopigmentation, postinflammatory hyperpigmentation, post-treatment purpura, mottled appearance, crusting and erythema have been reported.⁴–¹³ Multiple sessions with these treatments are usually necessary to obtain optimal clearing.²,⁶,¹⁰

We report the successful treatment of poikiloderma of Civatte on the neck using fractional photothermolysis. In contrast to selective photothermolysis, which aims to produce bulk thermal injury in particular targets within the skin, fractional photothermolysis creates thousands of targeted microthermal treatment zones (MTZ) and spares the surrounding tissue.¹⁴,¹⁵ To the best of our knowledge, this is the first reported case of fractional photothermolysis for the treatment of poikiloderma of Civatte.

Case Report

A 55-year-old Caucasian female patient with Fitzpatrick type II skin presented with a 3-year history of poikiloderma of Civatte on the neck that had previously been untreated (Figure 1). The past medical history was unremarkable. The patient denied any personal or family history of keloid formation, or recent isotretinoin use. The treatment area was thoroughly cleansed before the procedure using a gentle, abrasive skin cleanser. OptiGuide Blue (Scholar Chemistry, West Henrietta, NY, USA), an FDA-certified water-soluble tint, was applied to the treatment area to highlight the contours of the skin so as to allow the Intelligent Optical Tracking System to detect contact with the skin and to adjust the treatment pattern with respect to hand piece velocity. Thirty percent topical lidocaine ointment was applied for 1 hour before treatment. A single treatment with the 1,550 nm wavelength Fraxel®, SR laser (Reliant Technologies Inc., Mountain View, CA) at a pulse energy of 8 mJ and a final density of 2,000 MTZ/cm² was performed. During treatment, the patient noted mild pain, which she described as thermal in nature and which was alleviated by a temporary pause in treatment. Additionally, postoperative edema was noted, which resolved within 24 hours. Follow-up results at 2 weeks...
revealed a significant clinical improvement in the degree of erythema, dyschromia, and overall texture of her neck based on independent physician clinical assessment (Figure 2). The patient’s degree of satisfaction paralleled the physician’s assessment of improvement. A 2-month follow-up revealed persistence of improvement (Figure 3).

Discussion

Ideally, an effective treatment of poikiloderma of Civatte improves both vascular and pigmentary components of the condition. In selective photothermolysis, visible laser irradiation is the choice for treatment, as both hemoglobin and melanin are targeted at these wavelengths. However, studies have shown that the therapeutic outcomes are variable.

The blue-green argon laser was the first laser system used for treating poikiloderma of Civatte. Although it offered improvement, this treatment had significant side effects, most notably scarring. The 532 nm KTP laser introduced later was an improvement, although complicated by cases resulting in occasional hypopigmentation. The advent of pulsed dye lasers emitting at 585–595 nm has lead to more effective and reproducible treatment of poikiloderma of Civatte. However, post-treatment purpura may be encountered and may last several days. Uncommonly, scarring and mottled hypopigmentation have also been reported. Intense pulsed light with a broad wavelength spectrum of 515–1,200 nm has most recently been successfully utilized for the treatment of poikiloderma of Civatte;
erythema, purpura, and crusting have been described.12,13 Incomplete clearing of poikiloderma of Civatte is a result of poor penetration of visible laser irradiation depth in blood. For example, the light penetration depths in blood at 532 and 585 nm wavelengths are approximately 37 (absorption coefficient ≈ 266 cm⁻¹) and 52 µm (absorption coefficient ≈ 191 cm⁻¹),17 while the ectatic blood vessels of poikiloderma of Civatte are approximately 100 µm in diameter.12 As a result, large blood vessels cannot be completely coagulated, resulting in incomplete clearing of poikiloderma of Civatte.

Unlike the modalities based on selective photothermolysis, which aim to achieve homogeneous thermal injury in a particular target within the skin, fractional photothermolysis produces an array of microscopic regions of thermal injury surrounded by unjured dermal tissue. This “fractional” treatment was originally motivated by the faster wound healing response during skin rejuvenation if the entire area were treated at once, a result of small injury regions and short migratory paths for keratinocytes.14 Recent clinical studies indicate that fractional photothermolysis is effective in treating fine wrinkles, epidermal dyschromia, and remodeling acne scars.16–24 However, no reports on the efficacy of this modality on the treatment of poikiloderma of Civatte have been described.

The 1,550 nm wavelength emitted from the fractional photothermolysis laser largely targets tissue water and not melanin. Therefore, nonspecific thermal injury to the epidermis, which may induce scarring and hypopigmentation, is unlikely. This may especially be beneficial for the treatment of Fitzpatrick-type IV–VI individuals. Additionally, the “fractional” laser avoids bulk heating of the skin dermis, which is seen in conventional pulsed mid-infrared lasers. For a typical density of 2,000 MTZ/cm² at 8 mJ, approximately 18% of the treated area is actually heated with fractional photothermolysis. This reduces the risk of irreversible nonspecific thermal injury to the dermis, which may also result in scarring. By adjusting the optical focal depth and/or the energy of the laser, high local radiant exposure can be achieved.14 Hence, different tissue compartments (e.g., blood vessels, dermal melanin, and sebaceous glands) at various depths of the skin can be arbitrarily selected as the targets for photothermolysis. With an appropriate MTZ density, an effective macroscopic treatment can be achieved.

There are two hypotheses as to the targeting of dermal vascular structures. Fractional photothermolysis emits a wavelength that largely targets water. As water is a large component of blood vessels, it seems logical to conclude that irradiance at 1,550 nm may lead to fractional photothermal microvascular destruction with clinical benefits. Secondly, the microthermal zones of injury in the dermis produced by this device may randomly result in frequent direct hits to the dermal
vasculature. Laubach and colleagues recently reported histopathologic evidence of damage to dermal vasculature in patients undergoing fractional photothermolysis to support the latter hypothesis. It is likely that both hypotheses work synergistically to produce reduction in telangiectasias as seen in this case report.

The rapid improvement of the telangiectatic component of poikiloderma of Civatte with fractional photothermolysis further underscores the versatility and potential benefits of this new technology. Additionally, the uncomplicated treatment of nonfacial skin areas with a paucity of pilosebaceous glands, such as the neck, is an exciting consideration, particularly given the historical avoidance of these anatomic locations given the risks of scarring and dyschromia with other ablative techniques. Although fractional photothermolysis was an effective and safe modality in the treatment of poikiloderma of Civatte for the patient presented in this case report, further larger, long-term studies are needed to better elucidate the efficacy and safety of fractional photothermolysis treatment for poikiloderma of Civatte and to optimize treatment parameters.

References