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# Treatment of Poikiloderma of Civatte With Ablative Fractional Laser Resurfacing: Prospective Study and Review of the Literature

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## ABSTRACT

**Background:** Previous laser treatments for Poikiloderma of Civatte (PC) (i.e., Pulsed dye, Intense Pulsed Light, KTP and Argon) are limited by side effect profiles and/or efficacy. Given the high degree of safety and efficacy of ablative fractional photothermolysis (AFP) for photoaging, we set out to assess the efficacy of PC with AFP.

**Design:** A prospective pilot study for PC in 10 subjects with a series of 1–3 treatment sessions. Treatment sessions were administered at 6–8 week intervals with blinded physician photographic analysis of improvement at 2 months post-treatment. Evaluation was performed of five clinical indicators, erythema/telangiecatasia, dyschromia, skin texture, skin laxity and cosmetic outcome.

**Results:** The number of treatments required for improvement of PC ranged from 1 to 3, with an average of 1.4. For erythema/telangiecatasia, the mean score improved 65.0% (95% CI: 60.7%, 69.3%) dyschromia, 66.7% (95% CI: 61.8%, 71.6%), skin texture, 51.7% (95% CI: 48.3%, 55.1%) and skin laxity, 52.5% (95% CI: 49.6%, 55.4%). For cosmetic outcome, the mean score improved 66.7% (95% CI: 62.6%, 70.8%) at 2 months post treatment.

**Conclusion:** In this prospective study, AFP was both safe and effective for the treatment of the vascular, pigmentary and textural components of PC. The degree of improvement observed in wrinkling, creping and laxity after AFP has not been reported with prior laser treatments for PC.

## INTRODUCTION

### Background

Poikiloderma of Civatte (PC) is a common benign condition with symmetric involvement of the neck, lateral cheeks, and upper chest, associated with concomitant sparing of the photoprotected submental area.[1-4] The condition occurs most frequently in fair-skinned middle aged men and women, and oftentimes produces significant dyschromia and skin texture abnormalities.[1-4]

In clinical and epidemiologic studies of PC, the estimated prevalence of the condition was estimated to be 1.4% among dermatologic patients.[1-5] The mean age at diagnosis was significantly lower in females (47.8 years) than males (61.7 years).[1-5] The majority of patients (80–90%) had skin phototypes I or II.[1] The most common pattern of distribution is the 'v' and sides of the neck as well as the upper chest.[1] The face (preauricular and parotid gland) were also involved in 38% of patients.[1] The most common variant of PC present was the erythemato-telangiectatic clinical type (58%), followed by the mixed type (22%) and the pigmented type (20%).[1] Nearly half of patients (46%) were symptomatic, with symptoms including itching, burning and flushing.[1] The mean duration from onset to diagnosis was 6.2 years.[1] The disease course was slowly progressive (82%) and irreversible.[1]

PC is characterized clinically by a reddish-brown reticulate pattern of pigmentation, associated with telangiectasias and atrophic changes of the skin.[1-5] While the lesions are most typically asymptomatic, there are case reports of associated symptoms, including itching, burning and flushing.[1-5]

The pathogenesis of PC remains unknown, however, the distribution of lesions on sun-exposed skin suggests a central pathogenesis mechanism for damage induced by ultraviolet radiation.[6] Other factors which have been implicated in the pathogenesis of the disease include genetic predisposition, hormonal changes related to menopause and phototoxic or photoallergic reactions to chemicals in fragrances or cosmetics.[7-8]

A recent study evaluating the role of contact sensitivity and photosensitivity in the condition's pathogenesis demonstrated that there was a significantly greater frequency of positive reactions to fragrances in the PC group relative to the control group (chi2 value = 3.91, $p<0.05$).[8] Specifically, 25% of patients with PC had positive reactions to fragrance mix and/or Balsam of Peru.[8] In the photopatch testing group, none of the patients with PC had a positive photopatch test for any of the allergens tested.[8] It has been theorized that the reticular pigmentation observed may result from a delayed hypersensitivity reaction to perfume and/or cosmetic ingredients. Thus, patch testing with a standard series, including fragrance mixes, may be of value in PC. [8]

PC is characterized by distinct histologic and ultrastructural features, further supporting the theory that it represents a distinct

and unique entity. A histologic study analyzing the characteristic feature of PC in 50 patients revealed consistency in features of an atrophic (62%), flattened (84%) epidermis with hyperkeratosis (92%) and occasional follicular plugging (34%).[9] The most consistent and prominent feature across all specimens (100%) was the presence of diffuse solar elastosis in the papillary dermis.[9] The blood vessels were also invariably dilated in the majority of specimens (96%).[9] The most constant findings were swelling and disruption of the collagen fibers as well as focal degeneration of the collagen bundles.[9] The overall consistent changes in the dermal connective tissue, including prominent solar elastosis and degeneration of collagen bundles, provide morphologic evidence for the primary role of ultraviolet radiation in the pathogenesis of PC.[9]

To date, there has been no single effective treatment modality for PC. In the past, attempts to treat this condition by using electrosurgery, cryotherapy, argon laser and potassium titanyl phosphate (KTP) laser have yielded largely unsatisfactory effects.[10-11]

Recent studies utilizing Pulsed dye laser (PDL) at 585 nm wavelength with fluences of 6-7 J/cm2 with a 5-mm spot size have shown significant efficacy.[12-14] However, adverse effects of PDL treatment of PC include purpura, a mottled appearance, severe pigmentation and scarring.[12-14] In addition, as PDL targets primarily the vascular component of PC, no significant change is typically observed in the pigmented component of the condition.[12-14]

One of the most successful treatment modalities to date for PC has been intense pulsed light (IPL), given its versatility in targeting superficial pigmentation, telangiectasias and surface texture abnormalities.[15,22,30] IPL is noncoherent light, in a broad wavelength spectrum of 515 to 1,200 nm.[15] The treatment parameters, including pulse duration, mode, delay between pulses and fluence can all be varied to heat-specific targets and varying skin depth, including epidermal and dermal pigmentation and blood vessels in the papillary and reticular dermis.[15] In several studies, clearance rates of greater than 75% of both telangiectasias and hyperpigmentation have been observed; however, significant side effects have been reported with IPL for PC, including permanent hypo- and hyperpigmentation as well as changes in skin texure, including mottling and scarring.[15,22,30]

The latest advance in laser technology reported to have significant improvements in the clinical appearance of PC is nonablative fractional photothermolysis (NAFP, Fraxel SR, Reliant Technologies, Mountain View CA) as reported by Behroozan et al.[16] The authors reported that two weeks after a single treatment with non-ablative fractionated photothermolysis (NAFP), significant improvement was effected in degree of erythema, dyschromia and overall skin texture of the neck.[16] The authors postulated that with NAFP, different tissue compartments (i.e., blood vessels, dermal melanin and sebaceous glands) at various skin depths can be selected as targets. The most likely target for absorption with the 1550 nm NAFP device, in the treatment of PC, is the dermal blood vessels.[16] Through targeting dermal blood vessels, NAFP may lead to microvascular destruction with clinical benefits of improved erythema and skin texture.[16] In addition, the microthermal zones of injury in the dermis produced by the NAFP also likely result in random hits to dermal vasculature.[16] Support for this hypothesis comes from a recent study by Laubach et al,[17] in which the authors demonstrated histopathologic evidence of damage to dermal vasculature in patients undergoing NAFP. It is likely that both of these hypotheses of chromophore targeting of dermal vasculature and microthermal zones of heating resulting in random hits to dermal vasculture play a significant role in reducing telangiectasias after treatment with FP.

NAFP technology demonstrated significant improvement in the treatment of diverse facets of the cutaneous signs of photoaging, including the dyschromia, telangiectasias and skin texture abnormalities which characterize PC and the skin signs of photoaging.[17-18]

While NAFP demonstrated modest improvements in conditions, such as photoaging[17-18,23] and PC,[16] patients required multiple treatments to achieve significant results and even with multiple treatments, patients with significant textural and pigmentary abnormalities were only minimally improved with non-ablative energies.

Most recently in 2007, Hantash et al[29] described the first use of a novel "ablative" $CO_2$ fractional resurfacing device (AFP) which produces an array of microthermal zones of a customizable density and depth but which results in a confluent array of ablation and coagulation which extends through the stratum corneum, epidermis and dermis.[29] In the initial in vivo studies demonstrating the histologic and clinical effects of this prototype ablative fractionated $CO_2$ device, Hantash et al. confirmed with immunohistochemistry that persistent collagen remodeling occurred for at least three months post-treatment.[29] With the greater degree of injury with fractionated $CO_2$ and a greater and prolonged effect on collagen remodeling, several recent studies have demonstrated greater clinical improvement in the cutaneous signs of photoaging (rhytids, dyschromia and laxity) relative to NAFP.[26-29]

Given the greater efficacy in the literature in the cutaneous signs of photoaging after AFP,[26-29] we postulated that greater improvement in PC would be achieved with AFP relative to that previously reported with NAFP.[16] Herein, we present the first prospective study of AFP for PC.

## PATIENTS AND METHODS

The study protocol conformed to the guidelines of the 1975 Declaration of Helsinki and was approved by the St. Vincent Hospital Institutional Review Board and Ethics Committee, Car-

mel, Indiana. Written informed consent was obtained from all patients prior to enrollment. All patients were required to be available for longitudinal study over the course of the three-to-nine month study treatment and post-treatment evaluation. This period involved a pre-operative evaluation, a one-week post-operative visit and a two-month post-treatment visit.

The trial was a prospective pilot study for the treatment in 10 patients presenting to our office for desired treatment of PC between July 2008-November 2008. Patients were excluded from the study if they had active infections, current pregnancy, a history of isotretinoin use in the year prior to laser treatment, a history of keloid scarring, known allergy to topical lidocaine anesthetic or any cosmetic procedure in the area(s) of treatment in the 12 months prior to the study.

The treatment area was thoroughly cleansed before the procedure with a gentle skin cleanser. A bupivicane/lidocaine/tetracane topical local anesthetic mix was applied 30 minutes before treatment. Treatment was administered to the neck and upper chest with the Dermal Optical Thermolysis (DOT) Laser (Eclipse Med, Dallas TX), an ablative fractionated $CO_2$ laser (10,600 nm) at settings of 20 Watts, 500 pitch, 500 milliseconds. Forced cold air was administered during treatment for anesthesia utilizing the Zimmer Cooler device (LaserMed, Shelton, CT) at a setting of 5 at a distance of 3–4 inches from the skin surface. Patients received a series of 1–3 treatment sessions, given at six-to-eight-week intervals. The number of treatment sessions was determined by the degree of clinical improvement with treatment.

At two months after the final treatment, blinded physician evaluation of photographs was utilized to assess the degree of improvement in five clinical indicators: erythema, dyschromia, skin texture, skin laxity and overall cosmetic outcome. A quartile scale was utilized where '1' signified no signs of skin change associated with PC and '4' signified significant change in skin associated with PC. In addition, the degree of improvement was calculated as the percentage improvement between the initial treatment and the final visit at two months after the final treatment.

### Statistical Analysis

For each patient, the pre-treatment and post-treatment scores for each category were recorded, as were treatment number and final date of follow-up. Pre-treatment scores were recorded at baseline on the date of the first treatment. Post-treatment scores were recorded the date of final follow-up.

The percent change in score was calculated as the score difference divided by the baseline score. For each category (erythema, dyschromia, skin texture, skin laxity and overall cosmetic outcome) the absolute score change, raw percentage change, mean percentage change and 95% confidence intervals (CI) were calculated.

The paired t-test was utilized to test the change in each clinical indicator score (erythema, dyschromia, skin texture, skin laxity and overall cosmetic outcome) from baseline to month 2 post-treatment. P-values less than 0.05 were considered statistically significant.

## RESULTS

A total of 10 patients with PC were treated with an ablative fractional photothermolysis device, Dermal Optical Thermolysis (DOT) Laser (Eclipse Med, Dallas TX). Patients were seen for evaluation at one week and at two months after the procedure. Incidence of side effects of erythema, edema and pruritus were assessed at one week.

During treatment, patients reported minimal pain, which was alleviated with the use of the topical and cold air anesthesia. Minimal post-operative erythema and edema were noted by patients, which resolved within 48-72 hours post-treatment. Only one patient experienced prolonged erythema and pruritus which persisted at the one week post-treatment visit which resolved completely by one month post-treatment.

Cosmetic outcome of improvement in the features of PC was assessed by a blinded physician on photography at the 2 month post-treatment visit. A quartile scale was utilized where '1' signified no signs of skin change associated with PC and '4' signified significant change in skin associated with PC. The distribution, proportion, and descriptive statistics of all outcomes were considered.

The number of treatment sessions required for significant improvement of PC ranged from 1 to 3, with an average of 1.4 sessions (Table 1). For erythema/telangiecatasia, the mean score decreased from 3.6 pre-treatment to a mean of 1.2 at 2 months post-treatment ($p<0.05$) for a 65.0% mean improvement (95% CI: 60.7%, 69.3%) (Table 1). For dyschromia, the mean score decreased from 3.7 pre-treatment to 1.2 at 2 months post treatment ($p<0.05$), 66.7% mean improvement (95% CI: 61.8%, 71.6%) (Table 1). For skin texture, the mean score decreased from 3.4 pre-treatment to 1.6 at 2 months post treatment ($p<0.05$), 51.7% mean improvement (95% CI: 48.3%,55.1%) (Table 1). For skin laxity, the mean score decreased from 3.4 pre-treatment to 1.6 at 2 months post treatment ($p<0.05$), 52.5% mean improvement (95% CI: 49.6%,55.4%) (Table 1). For overall cosmetic outcome, mean score decreased from 3.7 pre-treatment 1.2 at 2 months post treatment ($p<0.05$), 66.7% mean improvement (95% CI: 62.6%,70.8%) (Table 1).

Clinical images of patients demonstrating improvement in PC are shown in Figures 1a-1b, Figures 2a-2b, Figures 3a-3b, Figures 4a-4b and Figures 5a-5b.

## DISCUSSION

Patients with PC usually seek treatment for cosmetic reasons to improve the erythematous, pigmented and finely wrinkled ap-

**TABLE 1.**

| Treatment of Poikiloderma of Civatte with Ablative Fractional Photothermolysis | | | | | | |
|---|---|---|---|---|---|---|
| | **Age/Gender** | **Erythema/ Telangiectasia** | **Dyschromia** | **Texture** | **Skin Laxity** | **Overall Cosmetic Outcome** |
| Patient #1 | 54 y/o Caucasian Female | | | | | |
| pre treatment | | 4 | 4 | 4 | 3 | 4 |
| 2 months post-treatment | | 1 | 1 | 1 | 1 | 1 |
| % improvement | | 75% | 75% | 75% | 75% | 75% |
| # treatment sessions | 3 | | | | | |
| Patient #2 | 71 y/o Caucasian Female | | | | | |
| pre treatment | | 4 | 4 | 4 | 4 | 4 |
| 2 months post-treatment | | 1 | 1 | 1 | 1 | 1 |
| % improvement | | 75% | 75% | 75% | 75% | 75% |
| # treatment sessions | 1 | | | | | |
| Patient #3 | 57 y/o Caucasian Female | | | | | |
| pre treatment | | 4 | 4 | 4 | 4 | 4 |
| 2 months post-treatment | | 1 | 1 | 2 | 2 | 1 |
| % improvement | | 75% | 75% | 50% | 50% | 75% |
| # treatment sessions | 2 | | | | | |
| Patient #4 | 61 y/o Caucasian Female | | | | | |
| pre treatment | | 3 | 4 | 3 | 3 | 3 |
| 2 months post-treatment | | 2 | 2 | 3 | 3 | 2 |
| % improvement | | 33.3% | 50% | 0% | 0% | 33.3% |
| # treatment sessions | 2 | | | | | |
| Patient #5 | 68 y/o Caucasian Female | | | | | |
| pre treatment | | 4 | 4 | 4 | 4 | 4 |
| 2 months post-treatment | | 1 | 1 | 1 | 1 | 1 |
| % improvement | | 75% | 75% | 75% | 75% | 75% |
| # treatment sessions | 1 | | | | | |
| Patient #6 | 73 y/o Caucasian Female | | | | | |
| pre treatment | | 3 | 3 | 4 | 4 | 4 |
| 2 months post-treatment | | 2 | 2 | 3 | 3 | 2 |
| % improvement | | 33% | 33% | 25% | 25% | 50% |
| # treatment sessions | 1 | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Patient #7 | 62 y/o Caucasian Female | | | | | |
| pre treatment | | 3 | 3 | 2 | 2 | 3 |
| 2 months post-treatment | | 1 | 1 | 1 | 1 | 1 |
| % improvement | | 66.7% | 66.7% | 50.0% | 50.0% | 66.7% |
| # treatment sessions | 1 | | | | | |
| Patient #8 | 65 y/o Caucasian Female | | | | | |
| pre treatment | | 3 | 3 | 2 | 3 | 3 |
| 2 months post-treatment | | 1 | 1 | 1 | 2 | 1 |
| % improvement | | 66.7% | 66.7% | 50.0% | 33.3% | 66.7% |
| # treatment sessions | 1 | | | | | |
| Patient #9 | 53 y/o Caucasian Female | | | | | |
| pre treatment | | 4 | 4 | 4 | 4 | 4 |
| 2 months post-treatment | | 1 | 1 | 2 | 1 | 1 |
| % improvement | | 75% | 75% | 50% | 75% | 75% |
| # treatment sessions | 1 | | | | | |
| Patient #10 | 50 y/o Caucasian Female | | | | | |
| pre treatment | | 4 | 4 | 3 | 3 | 4 |
| 2 months post-treatment | | 1 | 1 | 1 | 1 | 1 |
| % improvement | | 75% | 75% | 66.7% | 66.7% | 75% |
| # treatment sessions | 1 | | | | | |
| | **Average # Sessions** | **Erythema/ Telangiectasia** | **Dyschromia** | **Texture** | **Skin Laxity** | **Overall Cosmetic Outcome** |
| Mean pre-treatment score | 1.4 | 3.6 | 3.7 | 3.4 | 3.4 | 3.7 |
| Mean post-treatment score | | 1.2 | 1.2 | 1.6 | 1.6 | 1.2 |
| p value: pre vs post-treatment score | | p<.05 | p<.05 | p<.05 | p<.05 | p<.05 |
| Mean % Improvement | | 65.0% | 66.7% | 51.7% | 52.5% | 66.7% |
| 95% CI: | | 60.7%, 69.3% | 61.8%, 71.6% | 48.3%,55.1% | 49.6%,55.4% | 62.6%,70.8% |

pearance that occurs in visible areas on the neck and upper chest. Most importantly, the physician attempts to match the normal pigmentation of the submental region with the hyperpigmented skin of the adjacent neck. Given the cosmetically sensitive location of the condition, it is critical that an effective treatment be relatively risk free, with minimal risks of scarring and dyspigmentation, and that results are obtained in a limited number of treatment sessions to minimize discomfort and cost.

For optimal improvement of PC, both pigmentary and vascular components of the condition must be affected.[10-16] With selective photothermolysis, visible laser irradiation is the wavelength of choice as it targets both hemoglobin and melanin. One of the first treatment modalities studied for PC was pulsed dye laser (PDL) with a 585 nm wavelength.[11-14] With the small diameter of ectatic blood vessels in PC (0.1 mm) which are primarily in the papillary dermis and short thermal relaxation times of 0.1–10 µsec, the optimal settings for PDL treatment of PC were with a spot size of 5 mm, fluences of 5-7J/cm$^2$ and short pulse durations of 450 µsec.[11-14] While the PDL can result in photothermal coagulation of small and superficial vessels characterizing PC, vessel rupture characterized by thermal absorption of oxyhemoglobin, leads to the clinically undesirable side effect of purpura.[11-14]

For PDL treatment of PC, Geronemus[20] reported resolution of 95% of the redness associated with PC following four treatments

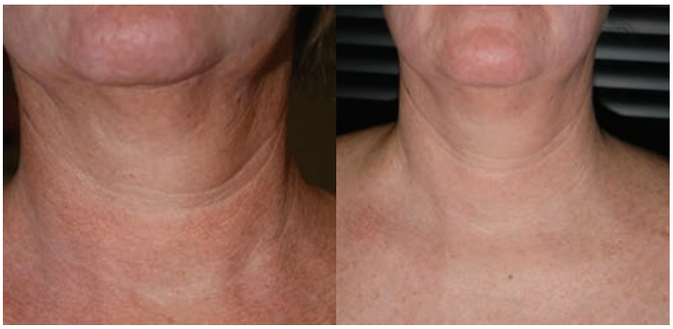

**FIGURE 1a-1b.** Pre (left) and Post (right) treatment of Poikiloderma of Civatte in a 54-year old Caucasian female at 2 months after 3 treatment sessions with Ablative Fractional Photothermolysis (DOT Laser, Eclipse Med, Dallas, TX).

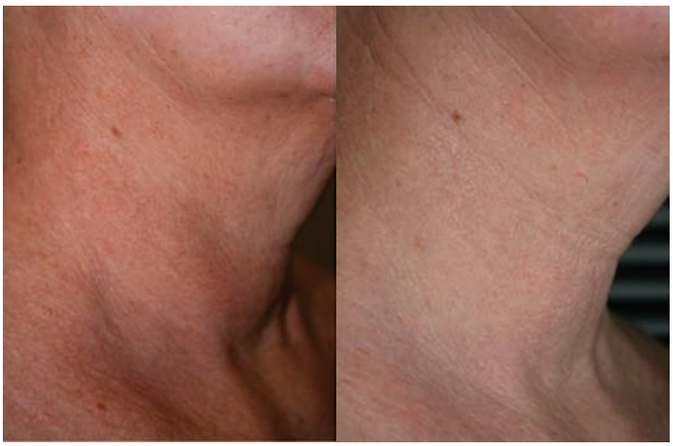

**FIGURE 2a-2b.** Pre (left) and Post (right) treatment of Poikiloderma of Civatte in a 54-year old Caucasian female at 2 months after 3 treatment sessions with Ablative Fractional Photothermolysis (DOT Laser, Eclipse Med, Dallas, TX).

with 6-7 J/cm$^2$ and a 450 µsec pulse. However, treatment side effects included a post treatment burning sensation and purpura persisted for 7-10 days. Wheeland and Applebaum[12] reported PDL treatment of PC with improvement in both vascularity and irregular pigmentation after treatment with a 585 nm PDL with settings of 5-6J/cm$^2$ and overlapping pulses of 360 µsec.

Goldman and Fitzpatrick[11] reported variable success rates with PDL treatment of PC, where vascular ectasias responded to treatment; however, epidermal atrophy and hypermelanosis failed to respond. In addition, significant adverse events were noted, including a post-treatment mottled response and hypertrophic scarring in one of four patients. Similarly, adverse effects of severe depigmentation were noted in six out of eight patients treated with PDL for PC in a study in the Netherlands, where higher fluences (5-7J/cm$^2$) were noted to correlate the increasing risk of depigmentation.[21]

Intense pulsed light (IPL) has also been widely reported for PC with the advantages of the broad spectrum of visible and infrared light affecting both hemoglobin and melanin, the two endogenous chromophores affected in the condition.[15,22,30]

In the largest patient series to date, Rusciani et al. reported the treatment of 175 patients with PC with IPL.[30] Each patient received three treatments at 3-week intervals.[30] Treatment fluences ranged between 32-36 J/cm$^2$. Energy was delivered in double or triple-pulse trains of 2.5 to 3.5 µsec with a pulse delay of 10 to 20 µsec.[30] A marked 75-100% reduction in poikiloderma lesions was observed in 142 of 175 patients (81.0%).[30] Of the remaining patients, 14% presented with a clearance of 50-74% and 5% presented with a slight improvement from 25-49%.[30] In terms of side effect profile, the primary side effect observed included erythema and swelling immediately after treatment, which lasted from 24 to 48 hours.[30] Mild purpura was noted in 32 of 175 patients, usually resolving within three to four days.[30] Only three patients experienced blister formation which gradually resolved in seven days without pigmentary disturbance or scarring.[30]

Similarly, Weiss et al.[22] reported five-year experience with treatment of the vascular and pigmentary changes of poikiloderma of Civatte with IPL. They observed a significant improvement of more than 75% in the telangiectasias and hyperpigmentation in the majority of patients (82%). Similarly, the cutoff filter parameters utilized initially were a 515-nm filter and a pulse duration of 2 to 4 µsec, in order to simultaneously treat the pigmented and vascular component of poikiloderma.[22] The overall results for patients were grade 3.82 (scale 0-5) improvement after an average of 2.78 treatments (range 1-5).[22] A significant proportion of the overall treatment effect was seen after the initial treatment, with 16 of 125 patients demonstrating 75% improvement after just a single treatment.[22] In total, a significant reduction of 75-100% in the hyperpigmentation and telangiectasias associated with PC, were seen in 111 out of 135 patients (82%) after an average of three treatments.[22]

While significant improvement in PC can be achieved with PDL and IPL, review of the literature demonstrates significant complications associated with both of these technologies, including transient prolonged purpura and permanent depigmentation associated with PDL and transient erythema, swelling and crusting as well as more modest improvements in skin coloration and texture with IPL.[15,22,30]

Given the limitations of these previous laser- and light-based modalities for PC, the introduction of FP with its ability to target vasculature, pigmentation as well as to effect improvements in skin texture and tightening, may represent an ideal treatment approach. In a case report, Behroozan et al.[16] demonstrated significant improvement in PC after a single treatment with nonablative fractionated photothermolysis (NAFP). Herein, utilizing ablative fractionated $CO_2$ laser technology (DOT Laser, Eclipse

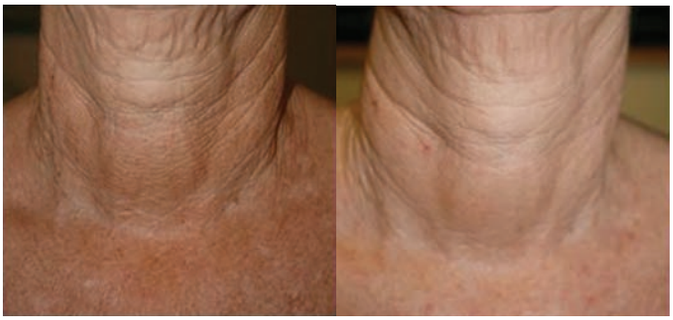

**FIGURE 3a-3b.** Pre (left) and Post (right) treatment of Poikiloderma of Civatte in a 57-year old Caucasian female at 2 months after 2 treatment sessions with Ablative Fractional Photothermolysis (DOT Laser, Eclipse Med, Dallas, TX).

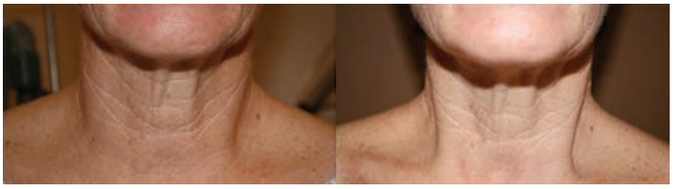

**FIGURE 4a-4b.** Pre (left) and Post (right) treatment of Poikiloderma of Civatte in a 53-year old Caucasian female at 2 months after 1 treatment session with Ablative Fractional Photothermolysis (DOT Laser, Eclipse Med, Dallas, TX).

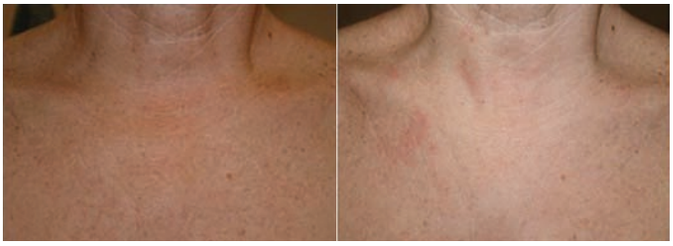

**FIGURE 5a-5b.** Pre (left) and Post (right) treatment of Poikiloderma of Civatte in a 53-year old Caucasian female at 2 months after 1 treatment session with Ablative Fractional Photothermolysis (DOT Laser, Eclipse Med, Dallas, TX).

Med, Dallas, TX), we have achieved similar improvements in surface pigmentation and vasculature,[16] with added benefits of improvement in skin texture and skin tightening. Specifically, after AFP the majority (7 out of 10) of our patients had 50-75% improvement in skin laxity and 9 out of 10 patients had 50-75% improvement in skin texture. The degree of improvement observed in skin wrinkling, creping and laxity after AFP has not been reported with prior laser based modalities for PC. The mechanism of action of fractionated laser resurfacing in PC is purely speculative, but may include microvascular destruction at varying skin depths leading to improvement in skin erythema and texture in addition to simulation of collagen remodeling and neo-collagenesis.

Most recently, ablative fractional photothermolysis has been demonstrated to achieve greater improvements in dyschormia and rhytids associated with photoaging relative to the original generation of non-ablative fractional devices.[26,27,29] Utilizing human forearm skin in vivo, Hantash et al.[29] demonstrated that with AFP, a controlled microthermal zone of injury could be induced with stimulation of the wound healing response by adjacent intact skin. With the greater degree of injury with AFP technology, Hantash et al. predicted a greater and prolonged effect on induction of new collagen and remodeling of dermal collagen resulting in greater improvements in skin laxity and texture.[29]

Given the histologically documented effects of FP on dermal vasculature and collagen remodeling,[23-29] the rapid improvement in PC after treatment with this technology further underscores the versatility and potential for novel applications of this unique technology. Similar to reports of rapid response to treatment with Intense Pulsed Light, an average of only 1.4 treatment sessions was needed to achieve 67% improvement in cosmetic outcome with ablative fractional photothermolysis. In addition, relative to the previous case report of NAFP, our prospective study of AFP reported the additional benefits of significant improvement in skin texture and laxity. Given the historical reports of purpura, crusting, scarring and permanent hyperpigmentation on the neck after treatment with other laser- and light-based modalities for PC, the safety profile of AFP on the neck makes this new technology particularly promising. However, given the limited scope of our study, additional validation is needed with this and other ablative fractionated devices to better elucidate the safety and efficacy of AFP for the treatment of PC.

## DISCLOSURES

The authors have no relevant disclosures or conflicts of interest.

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