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Pigmented and Depressed Facial Scar after an External Injury: Successful Treatment with 1,064-nm Picosecond Neodymium:Yttrium-Aluminum-Garnet Laser Simply Combined with a Fractional Beam-Splitter Handpiece

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A 29-year-old man presented with facial scars one and half years after an external injury. A physical examination revealed a slightly depressed linear scar with bluish brown pigments from traumatic tattoos on the nasal root. He was treated with a 1,064-nm picosecond neodymium:yttrium-aluminum-garnet (Nd:YAG) laser combined with a fractional picosecond mode by integrating a holographic beam splitter handpiece. After five sessions of this simple combined treatment modality, the patient achieved significant clinical improvement with no downtime period. To the best of the authors' knowledge, this is the first case of the effective treatment of facial scars after a skin injury using a 1,064-nm picosecond Nd:YAG laser together with a simple combination of a fractional beam splitter handpiece, successfully targeting both the traumatic tattoos and depressed scars.

Key words

Beam-splitter handpiece; Depressed scar; Picosecond laser; Tattoo

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INTRODUCTION

Skin scarring is a consequence of skin wound healing process influenced by multiple genetic and environmental factors.¹ There are several clinical categories of skin scarring such as, depressed scars, hypertrophic scars, and keloid scars.² According to the etiology of skin scarring, scars resulting from external injuries frequently present more complicated features including hypertrophy, depression, erythema, hyperpigmentation, and traumatic tattoos. Therefore, those scars tend to be challenging to treat due to their heterogeneous nature of shape, depth, and colors, which raise the needs for combination laser therapy to achieve optimal therapeutic outcomes. Here, we report a case of pigmented and depressed scars successfully treated with a 1,064-nm picosecond neodymium:yttrium-aluminum-garnet (Nd:YAG) laser simply combined with an additional fractional beam splitter handpiece for targeting both tattoos and depression.

CASE REPORT

A 29-year-old Korean male presented to our clinic with a linear facial scar following a traumatic external injury one and half year prior to his visit. Physical examination revealed a linearly depressed scar with bluish brown pigments on the nasal root (Fig. 1A). After initial evaluation, we performed total five sessions of laser therapy at one month interval using the 1,064-nm picosecond Nd:YAG laser (PicoWay®; Syneron-Candela Corporation, Wayland, MA, USA) with the fluence of range between 1.4-2.4 J/cm² for treating traumatic tattoos of the scar. From the second to the final sessions of the treatment, the patient was additionally subjected to the 1,064-nm picosecond Nd:YAG laser therapy equipped with a holographic beam-splitting fractional optic handpiece (PicoWay Resolve®; Syneron-Candela Corporation) with the fluence of range

between 1.5-1.7 J/cm² for total three passes per each treatment session for treating depression of the scar. Before treatment, an explanation of the risks, benefits, and potential complications of the procedure were given, and written informed consent was obtained. Anesthesia was achieved with a topical EMLA cream (AstraZeneca AB, Södertälje, Sweden) for 1 hour before each treatment. After two treatments in 2 months (two picosecond laser and one picosecond laser armed with beam splitting handpiece), there was a significant improvement in the pigmentation due to traumatic tattoos and the appearance of depression (Fig. 1B). A total of five sessions of laser therapy resulted in an outstanding clinical outcome without any delayed down-time and inconvenient side effects (Fig. 1C).

DISCUSSION

Traumatic external injuries can cause a highly heterogeneous features of scar phenotypes as a combination of erythema, pigment, hypertrophy, and atrophy. Especially, skin scarring of this etiology frequently leaves traumatic tattoos within the intradermal area of scar lesions which result in deleterious cosmetic issues.³ Those characteristics have led to test a wide range of laser modalities to achieve the optimal treatment outcome against the post-traumatic pigmented scars. It has been well established that traumatic tattoos would be efficiently treated by 1,064-nm Q-switched Nd:YAG laser with nanosecond pulse duration.⁴ However, based on the theory of selective photothermolysis,⁵ lasers emitting nanosecond pulse durations are not shorter enough to attain the most efficient tattoo removal. In addition, Asian patients treated with those nanosecond lasers are prone to be complicated by post-laser hyperpigmentation and scarring due to higher epidermal melanin contents compared to those of Caucasians.^{6,7} In light of this, almost twenty years ago Ross

Fig. 1. Clinical improvement of the facial scar on the nasal root after treatment with five sessions of 1,064-nm picosecond neodymium:yttrium-aluminum-garnet (Nd:YAG) laser simply combined with an additional holographic beam-splitter handpiece: (A) before the treatment, (B) after two sessions with laser treatment, and (C) before final session of the treatment.

et al. first reported that Nd:YAG laser with picosecond pulses showed more superior therapeutic effect than nanosecond pulses in clearing black tattoos.⁸ In addition, it has been also demonstrated that picosecond-domain Nd:YAG laser therapy was highly efficacious in the treatment of traumatic tattoos in Asians with great safety profiles.⁹ In our case, we successfully treated hyperpigmented traumatic tattoos by applying 1,064-nm picosecond Nd:YAG laser. For covering linearly depressed area, we treated the patient by simply incorporating a novel holographic beam-splitter to achieve fractional picosecond laser beams. It has been recently described that laser-induced optical breakdown in the skin in conjunction with picosecond-domain pulse durations led to a significant improvement in scar treatment.^{10,11} Although the traditional non-ablative and ablative fractionated laser therapies are widely accepted to treat various types of scars, including the depressed one by targeting water absorption, those lasers are often accompanied by significant hyperpigmentation when treating more darkly pigmented skin, such as Asian skins.¹² However, as in our patient, the subjects treated by split laser beams of picosecond laser usually experienced minimal or no downtime with an excellent clinical outcomes.¹³ Thus, we propose that 1,064-nm picosecond-domain Nd:YAG laser combined with an additional holographic beam-splitter would be a highly effective and reliable therapeutic approaches for the mixed features of pigmented and depressed post-traumatic scars especially complicated by traumatic tattooing.

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