Efficacy of 1064nm neodymium-doped yttrium aluminum garnet (Nd: YAG) laser and 2940nm fractional erbium laser for severe acne with acne scar: a case report

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ABSTRACT

Introduction: Pharmacological therapy is not always desirable because of the development of antibiotic resistance or the potential risk of adverse effects. Non-pharmacological therapies can be viable alternatives to conventional therapies. Recently, laser therapy has been widely used in the treatment of acne vulgaris due to its effectiveness and safety as it provides a more rapid response with less rate of recurrence, specifically 1064nm Nd: YAG laser. Few studies have investigated laser combinations. Combination 1064nm Nd: YAG and 2940nm fractional erbium laser for severe acne with acne scar has not been reported.

Case report: We report a case of severe acne with acne scars in a 21-year-old female, skin type IV, treated using 1064nm Nd: YAG laser in five sessions and 2940nm fractional erbium laser two sessions. Reduction of acne lesions counts and acne scars improvement prominent after Nd:YAG laser at least four sessions. Our patient’s acne scars improved not significantly after 2940nm fractional erbium laser. Acne remission was sustained through the follow-up period. There were no post-inflammatory hyperpigmentation and no exacerbation of acne lesions after the procedures.

Conclusion: 1064nm Nd: YAG laser is very effective for mild to severe acne and improves new acne scars. While 2940nm fractional erbium laser is more effective for mature scars.

Keywords: acne, acne scars, laser for treatment, 1064nm Nd: YAG laser, 2940nm fractional erbium laser.


INTRODUCTION

The use of oral and topical treatments can be limited in some patients because of ineffectiveness, inconvenience, poor tolerability, or side effects.1 Light-based therapies have long been applied to treating acne, either as a first-line, second-line or complementary treatment.2 Studies of lasers in the treatment of acne, including erbium glass, Nd: YAG, pulse dye laser (PDL), potassium titanyl phosphate (KTP) laser, diode laser, intense pulsed light (IPL) and photodynamic therapy, have been published.2-4, 1064nm Nd:YAG laser has been one of the most commonly used light sources due to the wide array of pulse durations.2 Mechanism of actions of 1064nm Nd: YAG laser in acne lesions includes 1) laser light excites Propionibacterium acnes (P.acnes) to produce porphyrins and free oxygen, which are cytotoxic to eliminate P.acnes bacteria; 2) the energy will heat the sebaceous glands to reduce their size and suppress sebum production; 3) coagulation of blood capillaries in inflammatory lesions will inhibit the inflammatory response and reduce the pressure around the tissue, thereby reducing erythema and pain; and 4) absorption of water-based laser energy in the deeper dermis causes the formation of new collagen thereby improving skin texture and reducing acne scars.3,5

Fractional erbium lasers have been used for the treatment of acne scars and photoaged skin but have not been thought of as treatment for actively inflamed acne lesions. The mechanism of action of this laser source might be related to the photothermal effect acting on follicular hyperkeratosis and contributing to skin microbe modulation. Until now, only two case reports regarding using fractional erbium laser for active acne.6,7 Unique combination of lasers appear to be safe in patients with Fitzpatrick skin type IV, and might be useful in treating moderate to severe acne vulgaris. Laser therapy is advantageous because it is an in-office treatment, which ensures patient adherence to therapy. In addition, it offers no systemic side effects that might complicate treatment when using oral acne medications.4 Active acne lesions can cause irreversible damage to the skin's microscopic structure, changes in color, texture, or both, which are clinically visible as acne scars. Acne scars commonly appear after healing of nodular type acne or acne with severe inflammation, prolonged duration, and acne cysts.8 The extent of scarring in acne

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can be reduced by early treatment during the inflammatory phase. An observational study of normal scarring shows that histologically the scar maturation process occurs over a year with fibroblastic changes in dermal layers of skin; however, clinically the appearance remains unchanged except from diminishing erythema as angiogenesis ceases. Lasers are another popular treatment option for acne scars, including 1064nm Nd: YAG from the traditional nonablative laser group and 2940nm fractional erbium laser from fractional ablative laser group.9

Although many different lasers have been studied for the treatment of acne, only a few studies to date have evaluated a combination of lasers.4 Combination of nonablative and fractional ablative lasers for severe acne with acne scar has not been reported. We report the efficacy of 1064nm Nd: YAG laser and the 2940nm fractional erbium laser in patients with severe acne and acne scars.

CASE REPORT

A 21-year-old female patient, skin type IV came to our skin clinic with chief complaint of painful inflamed acne almost all over her face for the past few months. Previous treatment history had been undertaken but had not provided significant improvement. There are genetic and acne scars predispositions. She has medical history of moderate acne and remission about five years ago and left several atrophic acne scars without any intervention. Acne began to appear again after the patient changed cosmetics. There was already a medical history from another doctor for her current complaint, but the acne has not yet improved. She becomes insecure. Physical examination found comedones, papules, pustules, several excoriated nodules with an erythematous base, atrophic acne scars and hypertrophic scars (Figure 1). The diagnosis was severe acne with acne scars. There is no history of drug allergy. In the first session, we did 1064nm q-switched Nd: YAG laser, fluence 800 mJ, without applying topical anesthesia. One month after Nd: YAG laser, the acne lesions improved, the number of non-inflammatory and inflammatory lesions was reduced, mature scar improved, but there were erythema and new texture

Figure 1. Comedones, several papules, pustules, excoriated nodules with an erythematous base, atrophic acne scars and hypertrophic scars.

Figure 2. One month after the 1064nm q-switched Nd: YAG laser, the number of non-inflammatory and inflammatory lesions was reduced. The degree of acne changed to a moderate degree, and the epidermis and dermis were damaged.

Figure 3. Three months after two sessions of 2940nm fractional erbium laser, acne reduced to moderate degree. Erythema, atrophic and hypertrophic scars not significantly improved.

Figure 4. Results after 1064nm q-switched Nd: YAG laser four times monthly, showed active acne remission and acne scars significantly improved.
demonstrated 1064nm long-pulsed Nd: YAG laser to be effective for treating not only inflammatory but also non-inflammatory acne lesions, with improvement on the treated as well as control sides, suggesting a systemic effect on the skin from this laser treatment. Lee et al.12 also report a case of acne vulgaris using 1064nm long-pulsed Nd: YAG laser two sessions monthly, the patient presented nearly complete improvement in the lesions with no remarkable side effects or recurrence over the duration of six months.

A prospective, split-face, randomized controlled trial to compare the clinical efficacy of IPL versus 1064nm long-pulsed Nd: YAG laser for acne found that there was no significant difference both lasers in reducing acne lesions.13 Efficacy of fractional ablative laser for acne has been reported. Singh et al.14 reported two cases of inflamed cystic acne using low fluence of 2940nm fractional erbium laser and showed progressive improvement. Guida et al.15 also found a visible improvement of skin texture and reduction of active acne from three acne patients treated using 2940nm fractional erbium laser. Our patient’s acne reduced gradually from severe to moderate degree with combined 1064nm Nd: YAG laser and 2940nm fractional erbium laser, but skin texture damage (erythematous, atrophic and hypertrophic scars) not significantly improve.

Scarring occurs early in acne and may affect some 95% of patients with this disease.14 Acne scars are more prone to occur in individuals with the Fitzpatrick IV-VI skin type.8 The severity of scar is related to degree of inflammation, extent of tissue damage, and duration of tissue damage.15 Acne and acne scars can harm the quality of life and lead to feelings of embarrassment and low self-esteem.9 Justifying the need for early inflammatory and nodulocystic acne treatment is the most important way to prevent acne scars.15,16 Scars may be erythematous, avascular, or both depending upon the size and mechanism of injury. Scar vascularity manifests as erythema due to imperceptible fine superficial capillaries and discrete telangiectasias. Short pulse laser for a scar with prominent telangiectasias, outcome selectively destroying relatively large blood vessels will not be achieved. Conversely, too long pulse laser, dyspigmentation and/or worsening of the scar may occur. Commonly used lasers for targeting vascular structures include PDL, Nd: YAG, KTP, and IPL.15

An acute scar or scar arrested in the immature healing phase can improve greatly through laser intervention. Mature scars also often demonstrate variations in erythema, pigmentation, thickness, and elasticity, but tend to respond more slowly to treatment.15 The degree of success in acne scar treatment greatly depends on the treatment modality according to acne scar type.14,13 Nonablative lasers target tissues in the dermis by selective photothermolysis to stimulate collagen and dermal remodeling to reduce acne scar appearance. These lasers have good efficacy for shallow boxcar and rolling scars and are less beneficial for icepick scars. Several reports showed 20%-50% improvement of acne scars using 1064nm Nd: YAG laser.9 Although improvement was noted with nonablative lasers, the results obtained were not as impressive as those from traditional ablative lasers. For this reason, a new concept in skin laser therapy, using fractional ablative lasers such as 2940nm fractional erbium laser has been designed to create microscopic thermal wounds to achieve homogeneous thermal damage at a particular depth within the skin.14

A clinical trial of dual treatment with ablative fractional laser and nonablative laser for acne scars in Asian patients revealed that this combination yielded the best results and fewer complications.11 The low-energy erbium laser has been shown to be safe and effective for the treatment of acne scars, wrinkles and inflamed cystic acne, but it should be noted a potential risk of worsening of atrophic scars with
Reduction of acne lesions counts and acne scars improvement prominent after Nd:YAG laser at least four sessions. Our patient’s acne scars improved not significantly after 2940nm fractional erbium laser. Acne remission was sustained through the follow-up period.

CONCLUSION
Nd: YAG 1064nm laser is very effective for mild to severe acne and provides good improvement for new acne scars. While 2940nm fractional erbium laser is more effective for mature scars. Further research is still needed to assess the role of fractional laser for active acne and appropriate time to perform revision of acne scars after acne lesions are controlled.

CONFLICT OF INTEREST
All author declares there is no conflict of interest.

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ETHICAL CONSIDERATION
Patient had received signed written informed consent regarding publication of the medical data in medical journal with confidentiality to personal information.

REFERENCE