Long-Pulsed 755-nm Alexandrite Laser-Induced Postinflammatory Hyperpigmentation Treated with 1,064-nm Nd:YAG Laser: Time Course Follow-Up

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Long-pulsed 755-nm alexandrite laser has been used effectively and safely for treatment of various pigmented lesions. However, in Asian patients, the risk of postinflammatory hyperpigmentation (PIH) is high when epidermal pigmented lesions are treated with this laser using a large beam size. In this report, we described a female patient with long-pulsed alexandrite laser treatment-induced PIH. We found that long-pulsed alexandrite laser-induced PIH presented clinically along with demarcated and darkly pigmented macules compared to PIH by other Q-switched pigment lasers. In addition, all of the lesions with PIH showed abrupt improvement rather than gradual improvement after eight sessions of 1,064-nm Q-switched Nd:YAG laser with low fluence. Additionally, we delivered 1,064-nm Nd:YAG laser energy on the PIH lesions using a quick pulse-to-pulse (Q-PTP) mode. We suggest that the additional use of a Q-PTP mode could have played an important role in the marked improvement of alexandrite-induced PIH.

Key words

Long-pulsed alexandrite laser; Post-inflammatory hyperpigmentation; Nd:YAG laser; Quick pulse-to-pulse; Dual pulse

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INTRODUCTION

Long-pulsed 755-nm alexandrite laser has been used for the treatment of pigmented lesions, including seborrheic keratoses, congenital melanocytic nevus, freckles, and lentigines.¹⁻³ A prospective split-face study demonstrated that a long-pulsed (100 microsecond-pulse width) alexandrite laser presented effective clinical outcomes equivalent to Q-switched (50 nanosecond-pulse width) 755-nm alexandrite laser for the treatment of freckles and lentigines with lower risk of adverse events.² Our study group also demonstrated that high fluence laser energy of a long-pulsed alexandrite with 3-millisecond pulse width effectively treated light- to dark-colored seborrheic keratoses with low risk of side effects in Asian patients.³

The use of longer wavelengths for the treatment of pigmentary lesions demonstrate more effective absorption of laser fluences to the target melanin pigments and lesser to the adjacent tissues, especially blood vessels.⁴ However, when the epidermal pigmented lesions are treated with long pulsed alexandrite laser using a large beam size, the risk of postinflammatory hyperpigmentation (PIH) is reportedly high up to about 40% in Asian patients.² In this report, we demonstrated a female patient with PIH, which was developed after the treatment of lentigines using a long-pulsed alexandrite laser. We treated the patient with low-fluence, Q-switched Nd:YAG laser in one week intervals and serially followed clinical response on a time course.

CASE REPORT

A 41-year-old Korean female patient presented to our clinic with malar distribution of light brown-colored melasma lesions with indistinct borders on the face. In addition, several discrete and variously sized light brown-colored lentiginous lesions were found on the forehead, anterior cheek, and perioral areas (Fig. 1A, 2A). Although the patient had been intermittently treated with topical bleaching agents and 1,064-nm Q-switched low-fluence Nd:YAG laser treatment, satisfactory clinical improvement was not obtained. She denied having any pertinent family history or past medical history.

After obtaining written informed consent, the patient was treated with eight sessions of 1,064-nm Nd:YAG laser (SPECTRA XT™, Lutronic corporation, Goyang, Korea) treatment at one-week intervals. The whole face was treated with 1,064-nm Q-switched single pulse Nd:YAG laser at the settings of 1.6 J/cm², a pulse duration of 5-10-nanoseconds, and a 7-mm spot size. A total of 2,000 shots were delivered on the entire face with appropriate overlapping. Additionally, she was treated with two sessions of long-pulsed 755-nm alexandrite laser (GentleMax; Candela, Wayland, MA, USA) therapy on the lentiginous lesions at one-month intervals during the course of weekly 1,064-nm Nd:YAG laser treatments. When treated with long-pulsed 755-nm alexandrite laser, topical EMLA cream (eutectic mixture of 2.5% lidocaine HCl and 2.5% prilocaine; AstraZeneca AB, Södertälje, Sweden) was used for local anaesthesia. The lesion was treated with the settings of a 3 millisecond-pulse width, 35 J/cm², a 6 mm-spot size, and single pass, creating

Fig. 1. Normal light-exposed photos show melasma and lentigines in a 41-year old woman (A) before, and (B) after 8 sessions of 1,064-nm Nd:YAG laser treatments and 2 sessions of long-pulsed alexandrite treatments. (C) Postinflammatory hyperpigmentation (PIH; arrows) was developed in two weeks after the third long-pulsed alexandrite treatment. (D) Improved PIH in two weeks after 10 sessions of low-fluence 1,064-nm Nd:YAG laser treatment.

Fig. 2. Ultraviolet light-exposed photos taken (A) before, and (B) after 8 sessions of 1,064-nm Nd:YAG laser treatments and 2 sessions of long-pulsed alexandrite treatments. (C) Postinflammatory hyperpigmentation (PIH; arrows) was developed in two weeks after the third long-pulsed alexandrite treatment. (D) Improved PIH in two weeks after 10 sessions of low-fluence 1,064-nm Nd:YAG laser treatment.

fine surface changes on the irradiated lesions. A dynamic cooling device with a setting of 0/0/20 (pre-irradiation cooling/delay/post-irradiation cooling) milliseconds was applied to cool the epidermis.

One week after the final 1,064-nm low-fluence Nd:YAG laser treatment, she presented improved melasma lesions, however, she complaint of remaining lentiginous lesions (Fig. 1B, 2B). Then, an additional single session of long-pulsed 755-nm alexandrite laser treatment with the same laser settings described above was performed on each lentiginous lesion. Two weeks after the last alexandrite treatment, she visited our clinic presenting with darkly pigmented macules on the face, which corresponded to the alexandrite-treated sites (Fig. 1C, 2C). We clinically diagnosed her new pigmented lesions with long-pulsed 755-nm alexandrite laser-induced PIH.

The patient was treated again with 1,064-nm Nd:YAG laser treatment at one-week intervals at the settings of 1.6 J/cm², a pulse duration of 5-10-nanoseconds, and a 7-mm spot size. A total of 2,000 shots were delivered on the entire face. In each session, additional 1,064-nm Nd:YAG laser treatments were delivered on the PIH lesions with the laser settings of a quick pulse-to-pulse (Q-PTP) mode, 6.0 J/cm² (irradiated at dual pulses of 3.0 J/cm² and 80-μsec intervals), a pulse duration of 5-10-nanoseconds, a 4-mm spot size, and 5 shots per each discrete lesion. Residual melasma lesions showed more improvements with the weekly 1,064-nm Nd:YAG laser treatments. However, noticeable changes in the PIH lesions was not obtained with 6 sessions of 1,064-nm Nd:YAG laser treatments. From the 8th session of treatment, however, PIH lesions abruptly improved, and both the PIH and underlying lentiginous lesions nearly

disappeared after 10 sessions of treatment (Fig. 1D, 2D). The lesions did not recur until 3 months after the final treatment and no other remarkable side effects were reported.

DISCUSSION

In this report, we demonstrated a female patient with long-pulsed alexandrite laser treatment-induced PIH. The settings of a 3 millisecond-pulse width, 35 J/cm², a 6 mm-spot size, and single pass, which could make fine surface changes on the irradiated lentiginous lesions was used as described in the previous report.³ According to previous reports, long-pulsed 755-nm alexandrite laser treatment at this laser setting presented effective clinical outcomes for the treatment of lentigines and seborrheic keratoses with various colors and types.^{1,3}

In addition, because the use of pre-irradiation cooling requires higher laser fluence setting and cannot always uniformly protect the irradiated epidermis,¹ we used integrated dynamic cooling device with a setting of 0/0/20 (pre-irradiation cooling/delay/post-irradiation cooling) milliseconds. The patient did not develop PIH after the two sessions of alexandrite laser treatment, however, the third alexandrite treatment resulted in PIH even with the use of same laser settings. Most of the dynamic cooling device-induced PIH clinically present as donut appearance or arcuate pigmented lesions.^{1,5} Therefore, we suggested that repetitive laser irradiation to the lentiginous lesions with reduced target chromophores could have resulted in the development of PIH.

We found that long-pulsed alexandrite laser-induced PIH clinically presented as well demarcated and darkly

pigmented macules compared to the PIH by other Q-switched pigment lasers. In addition, all of the lesions with PIH demonstrated abrupt improvement rather than gradual improvement after 8 sessions of 1,064-nm Q-switched Nd:YAG laser with low fluence. Increased melanin pigments in PIH have been suggested as the chromogens for 1,064-nm QSWY low-fluence treatment.⁶ In the present report, we treated the patient with 1,064-nm Q-switched Nd:YAG laser with low fluence as described in the previous report.⁶

Additionally, we delivered 1,064-nm Nd:YAG laser energy on the PIH lesions using a Q-PTP mode, which irradiates split fluence at dual-pulse intervals of 80-microsecond.⁷ Q-PTP mode or dual-pulse mode for the treatment of periorbital refractory melasma lesions and PIH revealed to have better clinical outcomes, is less painful during the laser treatment, and has lower risk of side effects.^{7,8} Split laser pulses with shortened intervals have been suggested to be irradiated approximately on the identical pigment chromophores.^{7,8} We suggest that the additional use of a Q-PTP mode could have played an important role in the marked improvement of alexandrite-induced PIH.

In summary, we demonstrated a female patient with PIH, which was developed after the treatment of lentiginous lesions using a long-pulsed alexandrite laser. The lesions with PIH were effectively and safely treated with low-fluence, Q-switched Nd:YAG laser using combined Q-switched single pulse and Q-PTP modes. However, further investigations on the therapeutic effect of Q-PTP mode for the treatment of PIH are needed.

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