



## CASE REPORT

# Treatment of Melasma and Post-Inflammatory Hyperpigmentation by a Picosecond 755-nm Alexandrite Laser in Asian Patients

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The picosecond lasers have shown to effectively treat tattoo pigments that are intractable to previous multiple Q-switched (QS) laser treatments. Therefore we hypothesized that a picosecond laser would show better efficacy with minimal adverse events in the treatment of melasma and post-inflammatory hyperpigmentation (PIH) that are difficult to treat with conventional QS lasers. Two patients with melasma and one patient with PIH were treated with a Picosecond 755-nm Alexandrite Laser (Cynosure, USA). All patients were Korean with skin type IV and no longer responding to QS laser treatments. Laser treatment was well tolerated in all the patients. Adverse events such as PIH were not reported during 8 weeks of follow up period. After the multiple treatment sessions, one patient reported fair improvement and two patients reported good improvement. Consistent with the clinical results, *ex vivo* skin model irradiated with a Picosecond 755-nm Alexandrite Laser also showed decreased epidermal keratinocyte necrosis compared with the 532-nm QS Neodymium-Doped Yttrium Aluminium Garnet Laser (Lutronic, Korea) yet decreased melanin content. In conclusion, the Picosecond 755-nm Alexandrite Laser may be useful for effective treatment of intractable melasma and PIH with fewer adverse events in dark Asian skin. (*Ann Dermatol*

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## -Keywords-

Melanosis, Picosecond laser, Postinflammatory hyperpigmentation

## INTRODUCTION

Q-switched (QS) lasers, which emit high-energy pulses in the nanosecond range at varying wavelengths, have been used with good efficacy for treatment of pigmented lesions. Use of a low-fluence QS neodymium-doped yttrium aluminium garnet (QSNY) laser or 'laser toning' has shown efficacy in treating various pigment disorders, including melasma and post-inflammatory hyperpigmentation (PIH) in Asian countries<sup>1</sup>. However, treatment outcomes are inconsistent, and adverse events such as rebound hyperpigmentation and mottled hypopigmentation have been reported, especially in darker-skinned patients<sup>1</sup>. The picosecond laser was introduced in the 1990s, and several studies have shown improved efficacy in clearing tattoo pigments compared with QS lasers<sup>2</sup>. Moreover, tattoo pigments that are intractable to multiple QS laser treatments have responded to picosecond lasers<sup>3</sup>. Chesnut et al.<sup>4</sup> reported successful treatment of a recalcitrant nevus of Ota with Picosecond 755-nm Alexandrite Lasers. Therefore, we hypothesized that a picosecond laser would show better efficacy with minimal adverse events in the treatment of melasma and PIH that are difficult to treat with conventional QS lasers.

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## CASE REPORT

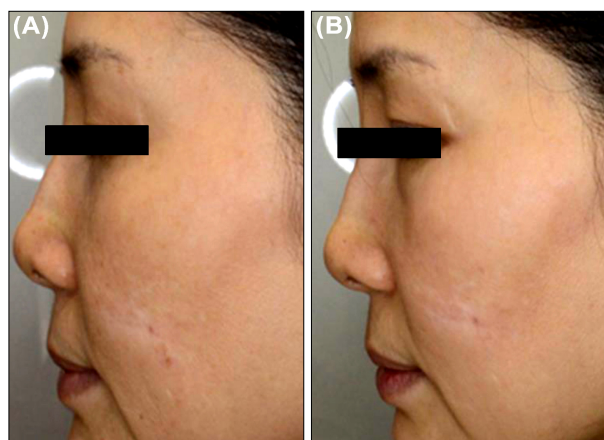
Two patients with melasma and one patient with PIH were treated with a 750-picosecond pulse using a 755-nm Alexandrite Laser (Cyanosure, Westford, MA, USA). All patients were Korean women with skin type IV. All patients had multiple previous low-fluence QSNY laser treatments but were no longer responding to such treatments. Informed consent was obtained for all patients. Two female patients, 53 and 45 years old (patient 1 and 2), had inhomogeneous pigmentation on their cheeks, noses, and temples, consistent with melasma and were treated with a spot size of 6 mm ( $0.57 \text{ J/cm}^2$ ) for 6 and 14 sessions, respectively, with two-week intervals in between treatments (Fig. 1, 2). One 20-year-old female patient (patient 3) had an ill-defined, 2-cm, brownish patch on her philtrum for more than 3 years that was diagnosed as PIH (Fig. 3). She was treated seven times, two weeks apart, with a 2-mm ( $5.25 \text{ J/cm}^2$ ) spot size. Laser treatment was well tolerated with minimal downtime. Post-laser erythema was not evident. Neither blistering nor petechia was reported. No patients had developed PIH at 8 weeks after laser treatment. The melasma lesions showed significant improvement at this time (Fig. 1~3). Patient 1 showed fair improvement and patients 2 and 3 showed good improvement.

An *ex vivo* skin model from the abdomen of a Korean female was irradiated with a Picosecond 755-nm Alexandrite Laser and a QSNY laser at 532 nm and 1,064 nm. The laser parameters were  $1.26 \text{ J/cm}^2$  with a 4.5-mm spot size,  $1 \text{ J/cm}^2$  with a 7-mm spot size, and  $3 \text{ J/cm}^2$  with a 7-mm spot size, respectively. Immunohistochemical staining using nitro blue tetrazolium was performed 4 hours after the laser treatment to see immediate effect of laser irradiation

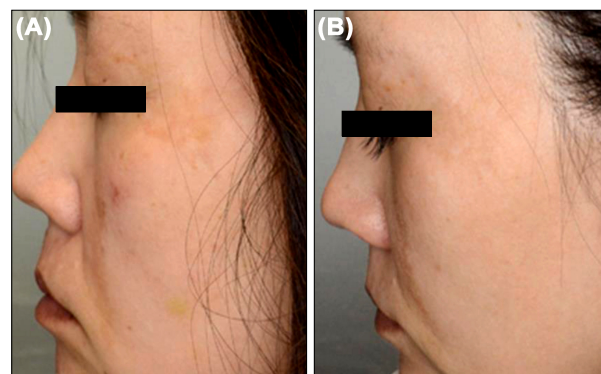
and detect viable cells. Remaining melanin pigments were quantitatively measured by Fontana-Masson staining 7 days after laser treatment using Image J (National Institutes of Health, Bethesda, MA, USA). *Ex vivo* experiments results were consistent with clinical outcomes. Four hours after the irradiation, the Picosecond 755-nm Alexandrite Laser led to decreased epidermal keratinocyte necrosis compared with the 532-nm QSNY Laser (Lutronic, Goyang, Korea) (Fig. 4). Quantitative measurements showed that the melanin content was decreased by both the Picosecond 755-nm Alexandrite Laser and the 1,064-nm QSNY Laser (Lutronic) (Fig. 4).

## DISCUSSION

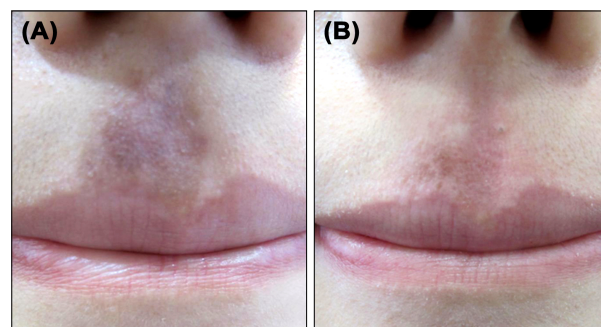
The Picosecond 755-nm Alexandrite Laser, which has a pulse duration that is much shorter than the thermal relaxation time of melanosomes, enabled us to selectively and effectively destroy melanosomes while causing minimal damage to surrounding tissues such as vessel hemoglobin



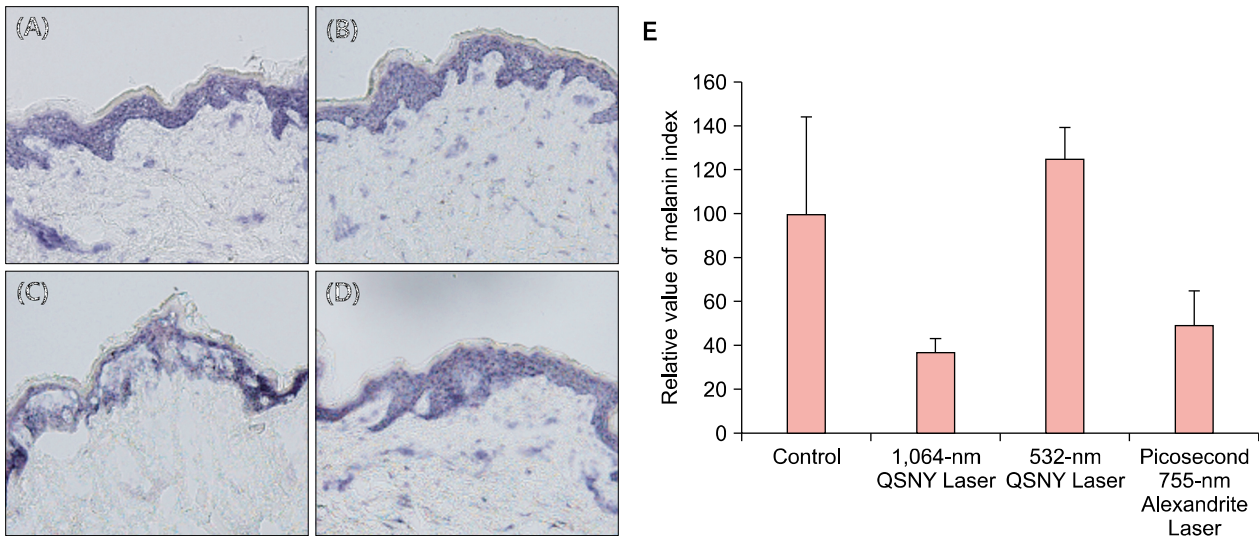
**Fig. 1.** Melasma in a 53-year-old female. (A) Findings at baseline. (B) Findings after six treatments of  $0.57 \text{ J/cm}^2$  with a 6-mm spot size using a Picosecond 755-nm Alexandrite Laser.



**Fig. 2.** Melasma in a 45-year-old female. (A) Findings at baseline. (B) Findings after 14 treatments of  $0.57 \text{ J/cm}^2$  with a 6-mm spot size using a Picosecond 755-nm Alexandrite Laser.



**Fig. 3.** Post-inflammatory hyperpigmentation in a 20-year-old female. (A) Findings at baseline. (B) Findings after seven treatments of  $5.25 \text{ J/cm}^2$  with a 2-mm spot size using a Picosecond 755-nm Alexandrite Laser.



**Fig. 4.** (A~D) Photomicrographs of a skin model stained for nitro blue tetrazolium after laser treatment: (A) control, (B) 1,064-nm Q-switched Neodymium-Doped Yttrium Aluminium Garnet (QSNY) Laser, (C) 532-nm QSNY Laser, (D) Picosecond 755-nm Alexandrite Laser; A~D,  $\times 200$ ). (E) Relative value of melanin index seven days after treatment. Quantitative measurement of melanin pigments was performed using Image J analysis following Fontana-Masson staining.

and epidermis. Low-fluence 1,064-nm QSNY Laser treatments of melasma or PIH often reach a steady state after multiple treatment sessions. Energy delivery in the picosecond range may achieve more selective photothermolysis of fragmented melanin granules from previous repetitive laser treatments<sup>5</sup>. With a picosecond laser, lower fluence can be used, which should decrease adverse effects while keeping the peak energy substantially higher than that typically produced by QS lasers. Except its high cost, the picosecond laser has a more favorable effect and safety profile to the QS nanosecond lasers.

In conclusion, the Picosecond 755-nm Alexandrite Laser may be useful for treating melasma and PIH that are intractable to conventional laser toning or residual lesions after QS lasers and shows high efficacy and fewer adverse events in dark Asian skin.

## ACKNOWLEDGMENT

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## CONFLICTS OF INTEREST

The authors have nothing to disclose.

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