

Efficacy of Long-Pulsed 755-nm GentleLASE Alexandrite Laser for Epidermal Pigmentary Lesions in Skin Types III-V

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Abstract

Objective: To evaluate the efficacy of the long-pulsed GentleLASE alexandrite laser in treating epidermal pigmentary lesions in patients with skin types III to V.

Methodology: This prospective, single-arm interventional study included 20 patients aged 18 to 66 years. Patients were recruited and treated from January to March 2026 at the Lahore branch of the American Laser of Cosmetic Dermatology. The study included 10 patients with freckles, four with senile lentigines/solar keratosis, and six with melasma. The entire face was initially treated using a 12-mm spot size at 12 - 16 J/cm² with dynamic cooling, followed by targeted lesion treatment at 16 - 20 J/cm² without dynamic cooling. Each patient was followed for three months, with assessments at one, two, and three months. Clinical improvement, patient satisfaction, adverse effects, photographs, and lesion clearance were assessed.

Results: Freckles showed 60 to 80% lesion clearance after one treatment session. Senile lentigines and solar keratosis demonstrated 80 to 100% clearance following a single treatment. Among six patients with melasma, four showed improvements despite previous resistance to other treatment modalities, whereas two showed no improvement. None of the melasma patients experienced worsening after treatment.

Conclusion: Long-pulsed GentleLASE alexandrite laser treatment produced substantial improvement in epidermal pigmentary lesions, particularly freckles, senile lentigines, and solar keratosis, with benefits often evident after a single session. Entire-face treatment followed by targeted regional treatment may additionally improve skin texture, translucency, and pores while maintaining patient satisfaction and avoiding occlusive dressings in selected patients with skin types III–V.

Keywords: Alexandrite laser; epidermal pigmentary lesions; freckles; melasma; senile lentigines; solar keratosis; skin pigmentation

Introduction

Treatment of epidermal pigmentary lesions, such as melasma, freckles, solar keratosis, and senile lentigines, poses a major challenge. Different treatment options are available, including oral agents, topical agents, microdermabrasion, ultrasound treatment, iontophoresis, light therapy,

and lasers. All treatment modalities have their own merits and demerits, with varying success rates among different patients.¹

Recent literature emphasizes that pigmentary disorders such as melasma often require an individualized and multimodal therapeutic approach, incorporating photoprotection, topical

and systemic treatments, chemical peels, and laser- or light-based procedures.²

Among the available treatment modalities, lasers have been increasingly used for the management of epidermal pigmentary lesions.³ Alexandrite and other pigment-targeting lasers have demonstrated efficacy for a variety of benign pigmented lesions. However, treatment outcomes may vary depending on lesion depth, skin type, laser parameters, and individual patient response, while post-inflammatory hyperpigmentation and hypopigmentation remain important considerations, particularly in darker skin types.⁴ Therefore, appropriate selection of the laser modality and treatment parameters is important for achieving favorable outcomes while minimizing adverse effects.

The alexandrite laser operates at a wavelength of 755 nm and targets melanin within pigmented lesions through selective photo thermolysis.⁵ This wavelength allows effective absorption by melanin and has been used for the treatment of several benign pigmented lesions, including freckles and lentigines. Long-pulsed alexandrite systems may provide effective pigment clearance while allowing controlled thermal injury to the targeted lesion.⁶ Nevertheless, appropriate fluence, pulse duration, epidermal cooling, and careful patient selection are particularly important in darker skin phototypes because of the greater epidermal melanin content and associated risk of pigmentary alteration

This study was designed to treat different epidermal pigmentary lesions using the 755-nm long-pulsed GentleLASE alexandrite laser by Candela Corporation. Previously, Katsumi Iwaki conducted a study in Japanese patients at the Iwaki Clinic, Tokyo, Japan. We conducted the

present study at the Lahore branch of the American Laser of Cosmetic Dermatology to evaluate the efficacy of the long-pulsed GentleLASE alexandrite laser in patients with skin types III to V.

Materials And Methods

A total of 20 patients with epidermal pigmentary lesions were included in the study. Approval from Institutional Ethics Committee was obtained prior to the commencement of this research (Ref. No. RE&TRC/0126/01/F). The participants ranged in age from 18 to 66 years, with an average age of 28 years. The male-to-female ratio was 1:9. Of the 20 patients, 10 presented with freckles, four with senile lentigines and solar keratosis, and six with melasma.

2.1 Study Design

This prospective, single-arm interventional study was conducted at the Lahore branch of the American Laser of Cosmetic Dermatology. Patients were recruited and treated over a three-month period from January 2026 to March 2026. Each patient was followed for three months after laser treatment, with follow-up assessments performed at one, two, and three months. The study evaluated the efficacy of the long-pulsed 755-nm GentleLASE alexandrite laser for the treatment of epidermal pigmentary lesions in patients with skin types III to V.

2.2 Inclusion Criteria

Patients with epidermal pigmentary lesions, including freckles, senile lentigines, solar keratosis, and melasma, were included in the study.

2.3 Exclusion Criteria

Patients with other skin disorders or systemic illnesses were excluded. Patients receiving laser treatment for other conditions and those receiving systemic tretinoin (Roaccutane) were also excluded.

2.4 Laser Equipment

The GentleLASE alexandrite laser, originally developed for hair removal, was used for treatment. The system operates at a wavelength of 755 nm with a pulse width of 3 milliseconds and a repetition rate of 1 Hz. Available spot sizes included 8 mm, 3 × 10 mm, 12 mm, 15 mm, and 18 mm. The laser was equipped with a Dynamic Cooling Device (DCD) to provide epidermal cooling and enhance treatment safety.

2.5 Treatment Protocol

The entire face was initially treated using a 12-mm spot size at a fluence ranging from 12 to 16 J/cm², depending on the patient's skin type. Dynamic cooling was applied using DCD settings of 30/20 milliseconds. Following full-face treatment, the fluence was carefully increased to 16 to 20 J/cm², and individual pigmentary lesions were treated without DCD.

Immediately after laser treatment, the treated area was cooled for five minutes, followed by the application of a topical corticosteroid cream.

Patients were advised to use sunscreen with a sun protection factor greater than 30. Makeup was permitted from the following day.

2.6 Follow-up and Outcome Assessment

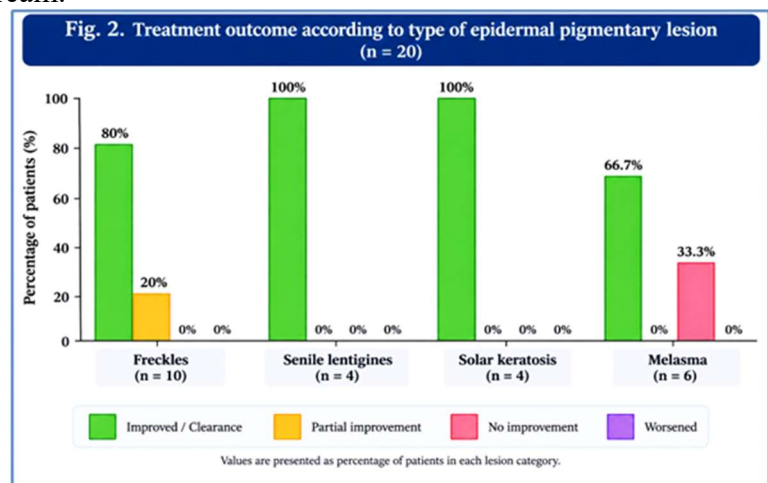
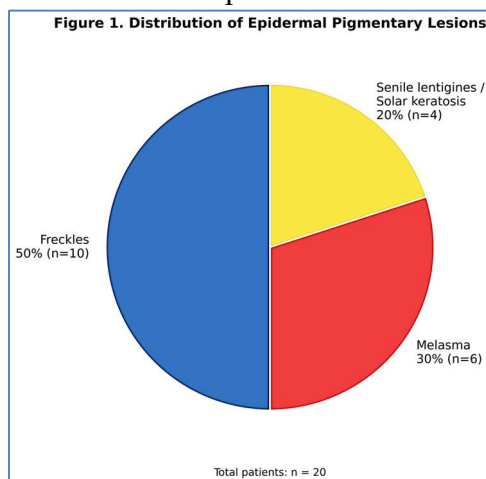
Patients were followed at one, two, and three months after treatment. During each follow-up visit, patients were questioned regarding clinical improvement, satisfaction with treatment, and the occurrence of any adverse effects. Clinical photographs were obtained and compared with pretreatment photographs. Treatment efficacy was assessed primarily according to the clearance rate of the pigmentary lesions.

2.7 Ethical Considerations and Informed Consent

Informed consent was obtained from all patients before treatment. Patients were informed about the laser procedure and treatment before undergoing the intervention.

Results

A total of 20 patients with epidermal pigmentary lesions underwent treatment with the long-pulsed 755-nm GentleLASE alexandrite laser. The participants ranged in age from 18 to 66 years, with a mean age of 28 years, and the male-to-female ratio was 1:9. Of the 20 patients, 10 (50%)



had freckles, 4 (20%) had senile lentigines/solar keratosis, and 6 (30%) had melasma (**Figure 1**). Treatment response varied according to the type of pigmentary lesion (**Figure 2**). Patients with freckles demonstrated 60–80% clearance of lesions following a single treatment session. The greatest clearance was observed in patients with senile lentigines and solar keratosis, with 80–100% lesion clearance following a single treatment. These findings indicate a greater and more consistent response of these epidermal lesions to the long-pulsed alexandrite laser compared with melasma.

Among the six patients with melasma, four (66.7%) showed clinical improvement following laser treatment despite previous resistance to other treatment modalities, including iontophoresis. The remaining two patients (33.3%) showed no improvement. None of the patients demonstrated worsening of melasma following treatment.

Overall, treatment response differed according to the type of epidermal pigmentary lesion. Freckles, senile lentigines, and solar keratosis showed substantial lesion clearance after a single treatment, whereas the response of melasma was comparatively variable. Nevertheless, two-thirds of the patients with melasma showed improvement, and no worsening of pigmentation was observed during the study.

Discussion

The present study demonstrated a favourable response of epidermal pigmentary lesions to the long-pulsed 755-nm GentleLASE alexandrite laser, although treatment efficacy varied according to lesion type. Freckles showed 60–80% clearance after a single treatment session,

whereas senile lentigines and solar keratosis demonstrated 80–100% clearance. These findings are consistent with the established ability of the 755-nm alexandrite wavelength to target melanin-containing lesions. Bonan et al. reported favourable improvement of benign hyperpigmentation, including solar lentigines and ephelides, using a 755-nm alexandrite laser, with treatment efficacy also demonstrated across different skin phototypes.⁷ Similarly, Vachiramon et al. demonstrated significant improvement in solar lentigines following 755-nm picosecond alexandrite laser treatment, with more than 50% improvement observed in most treated lesions.⁸

The favorable response of freckles and lentigines observed in the present study is also consistent with earlier evidence specifically involving long-pulsed alexandrite lasers. Ho et al. compared long-pulsed and Q-switched alexandrite lasers for freckles and lentigines in Asian patients and found significant improvement with both modalities. Importantly, post-inflammatory hyperpigmentation occurred less frequently following long-pulsed treatment than following Q-switched treatment, suggesting a potential advantage of longer pulse durations in darker skin types.⁹ Nevertheless, laser treatment in darker skin requires caution. A retrospective study of Asian patients demonstrated variable responses to different pigment-specific lasers and highlighted the importance of treatment parameters in reducing the risk of post-inflammatory hyperpigmentation.¹⁰ These considerations are particularly relevant to the present population, which included Fitzpatrick skin types III–V.

The present study also observed improvement in overall skin texture, tone, translucency, and the appearance of pores following entire-face treatment before targeted treatment of individual lesions. The use of dynamic epidermal cooling may have contributed to treatment tolerability and protection of the epidermis. Furthermore, the relatively thin crust and lack of requirement for occlusive dressings may provide practical advantages for patients. However, these secondary cosmetic outcomes were based on clinical observations rather than standardized objective scales and should therefore be interpreted cautiously.

Melasma showed a less consistent response than freckles, senile lentigines, and solar keratosis. Four of six patients with melasma (66.7%) demonstrated improvement, whereas two (33.3%) showed no improvement, and none showed clinical worsening. This variable response is consistent with the complex and recurrent nature of melasma. A 2023 network meta-analysis of 39 clinical studies involving 1,394 participants found substantial variation among laser-related therapies and emphasized that treatment efficacy depends on the modality used and whether laser therapy is combined with other treatments.¹¹ More recent reviews similarly emphasize that lasers should generally be considered within a multimodal treatment strategy rather than as universally effective monotherapy for melasma.¹²

Evidence specifically involving the 755-nm alexandrite wavelength provides further context for the present findings. A randomized controlled trial comparing 755-nm picosecond alexandrite laser, 1064-nm picosecond Nd:YAG laser, and hydroquinone in patients with Fitzpatrick skin

types III–IV demonstrated significant improvement in all treatment groups. However, the 755-nm alexandrite laser was not superior to hydroquinone, illustrating that response to alexandrite treatment in melasma may be clinically meaningful but variable.¹³ Similarly, a randomized split-face study found that combining a 755-nm picosecond laser with topical 20% azelaic acid could improve facial melasma, supporting continued investigation of laser-based combination approaches.¹⁴ These studies used picosecond technology and therefore cannot be directly extrapolated to the long-pulsed GentleLASE system used in the present study, but they provide relevant evidence concerning the 755-nm wavelength in melasma.

Long-term outcome is another important consideration. Zhou et al. conducted a randomized split-face controlled study with two years of follow-up and reported recurrence or exacerbation of melasma in 58.82% of participants, emphasizing that short-term improvement following laser treatment does not necessarily indicate sustained disease control.¹⁵ This is particularly relevant because the present study followed patients for only three months. Longer follow-up would therefore be necessary to determine whether the observed improvement persists and to assess recurrence.

Recent evidence further supports a cautious approach to alexandrite laser treatment for melasma. A 2026 systematic review and meta-analysis of randomized controlled trials evaluating 755-nm picosecond alexandrite lasers found that triple-combination topical therapy produced greater improvement in Melasma Area and Severity Index scores than picosecond alexandrite laser therapy. Post-inflammatory

hyperpigmentation was also more frequent with picosecond alexandrite treatment than with topical therapy, although irreversible adverse events were uncommon.¹⁶ These findings reinforce the importance of appropriate patient selection, conservative laser parameters, epidermal cooling, strict photoprotection, and careful follow-up, particularly in patients with darker skin phototypes.

Overall, the present findings support the potential effectiveness of long-pulsed 755-nm alexandrite laser treatment for selected epidermal pigmentary lesions, with the most consistent responses observed in freckles, senile lentigines, and solar keratosis. Melasma demonstrated a more variable response and should therefore be treated more cautiously. The study is limited by its small sample size, single-arm design, absence of a control group, short follow-up period, and lack of standardized quantitative pigmentation scores. Future randomized controlled studies with larger samples, objective pigmentation assessment, standardized photographic evaluation, systematic recording of adverse events, and longer follow-up are required to determine treatment durability and safety in Fitzpatrick skin types III–V.

Conclusion:

Entire face treatment of long-pulsed alexandrite laser provides advantages effects, such as in treating epidermal pigmented lesions, especially widespread small lesions, improvement of skin texture, translucency, and pores can be achieved with the entire face treatment prior to the regional treatment, patients' contentment, effective treatment result is often achieved on melasma, no occlusive dressing is required so that patients' quality of life can be retained, and combined with

the other treatment methods it enhances effectiveness of treatment.

Conflict of Interest None

Funding Source None

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Author's Contribution:

FMC : Conceptualization of Project, Data Collection, Literature Search, Data Analysis, Writing Manuscript, Drafting Revision