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Facial Rejuvenation in Indonesian Skin With a Picosecond 755-nm Laser

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Abstract

Introduction: The aging process in the skin naturally happens over time, affected by several factors, of which ultraviolet irradiation is a major factor, and this leads to the appearance of wrinkles, pigmentations, and textural irregularities. Lasers for facial rejuvenation are very popular in Asian patients, but melanin rick skin types like Asians are more susceptible to pigmentary alterations. Most Indonesians have brown skin, and just a few have light skin. The purpose of this study was to know the efficacy and safety of the picosecond 755 nm laser in facial rejuvenation in Indonesian skin.

Methods: This is an analysis of 20 healthy patients with Fitzpatrick skin type III-V with facial photoaging from 36 to 55 years. Examinations were evaluated before therapy and 4 weeks after the second therapy. The front and side of both cheeks were photographed and analyzed by using VISIA. Clinical improvement was categorized as excellent-mild. The patients were also asked and examined about the presence of adverse events.

Results: The patients were predominantly female with an average age of 44 years. Sixty percent of the patients had a good improvement and 40% of the patients had a moderate improvement. The VISIA analysis showed a significant improvement in wrinkles, pigments, and textures ($P<0.001$). Only mild anticipated adverse events were observed, and there was no post-inflammatory hyperpigmentation or hypopigmentation.

Conclusion: the picosecond 755 nm laser is effective and safe for facial rejuvenation in the skin of Indonesian patients without significant adverse events.

Keywords: Aging; Laser; Picosecond; Rejuvenation; Skin.

Introduction

The aging process in the skin naturally happens over time, affected by several factors like genetics, environmental exposure, hormonal and metabolic factor that will transform the function and appearance of the skin. Ultraviolet irradiation is a major factor that will cause skin aging, leading to the appearance of wrinkles, pigmentations, and textural irregularities. Skin aging may disturb psychologically, causing patients to look for suitable therapy.[1-3] In the past, the skin rejuvenation process was associated with aggressive therapy, but recently patients want noninvasive therapy for skin rejuvenation. Skin resurfacing to rejuvenate and repair the skin continues to evolve. Patients' demand for faster downtime with a natural look has increased. Restoring and reversing the effects of aging with a laser is suitable for the demand because of the effectiveness with minimal downtime and risk of complication.[1,3,4]

The science of lasers is very developing in novel medicine. Picosecond pulses that pulse in 10^{-12} seconds can cause high temperatures, and picosecond lasers deliver a very fast power, resulting in high pressure in target tissue that will cause minimal thermal diffusion. One of the indications of the picosecond laser is skin revitalization because of the reduction of wrinkles, benign pigmentation, and also textural improvement. The laser for skin revitalization, mainly for facial rejuvenation, is very popular in Asian patients, but melanin rick skin types like Asians are more susceptible to pigmentary alterations post-laser.[5,6] Most Indonesians have brown skin and just a few have light skin, and as we know, treating colored skin has to weigh the unique characteristics of pigment in the skin and its response to laser energy.[7,8] This research aimed to know the efficacy and safety of the picosecond laser in facial rejuvenation in Indonesian skin.

Methods

This is an analysis of 20 healthy patients with Fitzpatrick skin type III-V with facial photoaging from 36 to 55 years, and they were recruited between March 2021 and August 2021. The patients were 19 females and 1 male. Data like age, gender, and skin type were recorded. The patients

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who received other procedures for cosmetics such as peeling, botulinum toxin injection, filler, intense pulsed light, and lasers in the past 6 months were excluded. All the patients who joined in this research received two treatments with a 4-week interval and a 4-week follow-up. This study used a picosecond 755 nm laser with a diffractive lens array (DLA) (PicoSure, Cynosure, MA). Topical anesthesia (lidocaine 2.5% and prilocaine 2.5%) was given in the area of the therapy with cling-film occlusion for 30 minutes before therapy. The same parameters were given to all patients (6 mm, 0.71 J/cm^2, 10 Hz), and at least 3 to 4 passes were performed until the endpoint which was mild erythema was achieved. Normally, we used the laser parameter based on the skin type, but because this was for research, we used the same parameter for every patient. Objective examinations were evaluated before the therapy and 4 weeks after the second therapy using VISIA (Canfield Scientific, Inc.). The front and side of both cheeks were photographed, then VISIA assessing the number of visible wrinkles, pigment, and texture also provided a score, with a lower score indicative of fewer visible wrinkles, pigment, and texture. Clinical improvement was categorized as excellent (>75% improvement), good (50%-75% improvement), moderate (25%-50% improvement), and mild (<25% improvement), compared with the baseline. The patients were also asked and examined about the presence of adverse events.

Results

Twenty patients with skin type III-V, who participated in this study, were mostly female (95%), and their average age was 44 years (from 36 to 54); patient demographic data are represented in Table 1. Sixty percent (n = 12) of the patients had a good improvement (Figure 1) and 40% (n = 8) of the patients had a moderate improvement. A significant improvement in wrinkles, pigments, and textures ($p < 0.001$) was exhibited with VISIA (Table 2).

Only mild adverse events occurred (Table 3). Erythema and slight edema already expected happened in all patients; five patients experienced urticaria, and two patients with Fitzpatrick skin type III experienced petechiae. All adverse events disappeared several days after the usage of moisturizers and sunscreen without permanent sequelae. Urticaria healed within an hour; erythema and slight edema subsided within one day, while petechiae alleviated within two days after laser treatment. We followed up on the adverse events every day until adverse events subsided. There were no post-inflammatory hyperpigmentation or hypopigmentation.

Discussion

This retrospective study of 20 patients represented the results of a picosecond 755 nm laser using a special lens (DLA) for facial rejuvenation in Indonesian patients.

Figure 1. Before and After Therapy. Upper: before therapy, Lower: after therapy

Table 1. Patient Data

Total	n = 20
Gender	
Female	19 (95%)
Male	1 (5%)
Mean age (min-max)	44 (36, 54)
Skin phototype (I-VI)	
III	2 (10%)
IV	9 (45%)
V	9 (45%)

Table 2. VISIA Analysis Result

	Before (Mean ± SD)	After (Mean ± SD)	*P* Value
Wrinkles	237.10 ± 45.033	186.90 ± 48.275	<0.001
Pigments	399.00 ± 133.905	379.20 ± 125.422	<0.001
Textures	5321.85 ± 2609.776	4519.85 ± 2378.085	<0.001

Table 3. Post-laser adverse event

	No. (%)
Erythema	20 (100)
Edema	20 (100)
Urticaria	5 (25)
Purpura	2 (10)

This picosecond 755 nm laser was effective in treating wrinkles, pigmentations, and textural irregularities, which was confirmed by a clinical improvement with VISIA. A significant improvement appeared as soon as 4 weeks after the second treatment. The picosecond laser with minimal thermal diffusion could be an alternative for higher skin type patients with skin aging while minimizing secondary pigmentary alterations. A DLA is an additional lens that attaches to the handpiece that will redistribute and deliver energy and then cause a dermal healing response

through activating cell signaling. The picosecond 755 nm laser with DLA optics works with melanin as the main target that can form LIOB which then causes focal vacuoles in the stratum spinosum of the epidermis. This injury profile is very different from the dermal damage and epidermal features seen in previous laser technology. Keratinocytes induce cytokines, chemokines, and growth factors to respond to the injury that could stimulate and regulate receptors' cells in the epidermis and dermis. The formation of LIOB could cause a pressure wave that will release cytokine and cell signaling and then initiate dermal remodeling and wrinkle improvement.[6,9-11] Tanghetti performed a histopathological examination which showed that the number and the density of vacuoles depend on the melanin index and the energy supplied, and melanin that absorbs laser energy will cause the generation of localized vacuoles in the epidermis.[8,9] A study performed serial biopsies that taken at baseline and 1, 3, and 6 months after therapy. The biopsy 1 month after therapy showed vacuolization in the basal layer keratinocytes, increased dermal collagen (larger and denser volume), and increased elastic fibers with perivascular inflammatory infiltrate. Biopsy 3 months after treatment showed histology without inflammatory infiltrates and increased collagen and elastic fiber density. Biopsy 6 months after treatment showed an increase in dermal collagen significantly, and the elastic fibers appeared thicker and denser. Histology samples correlated with an improvement in the appearance of photodamage with a reduction in wrinkles and an improvement in skin color and texture.[12]

The clinical results of the DLA by delivering high-energy microbeams and the absorption of melanin to a 755-nm wavelength delivered at picosecond pulses will target the unwanted pigmentation and improve the skin's texture through the production of new collagen and elastin.[6,9] The picosecond 755 nm laser with DLA optics works with melanin as the main target. In the LIOB formation, the initial process is electron generation after laser irradiation to the tissue, and the energy threshold required to generate electrons without a chromophore is very high; therefore, a chromophore that can absorb thermal effects is needed to lower the energy threshold. Melanin and hemoglobin are the main chromophores in the skin. The picosecond laser with a 755-nm wavelength is preferred because the laser energy is mostly absorbed by melanin and less by oxyhemoglobin.[13,14]

This research indicates that a picosecond 755-nm laser with DLA is safe for facial rejuvenation in the skin of color. There was no post-inflammatory hypo/hyperpigmentation in all the patients. Erythema and edema in most of the patients dissolved in less than 24 hours after the therapy. The wavelength of 755-nm irradiation normally spreads into the dermo-epidermal junction, but once LIOB is formed, it absorbs the subsequent incoming laser irradiation and causes a very precise and localized absorption of laser irradiation, and it will not propagate to the dermo-epidermal junction. Thus, the pigment will be protected because of minimal collateral damage.[8,10] Two patients with skin type III in this study experienced petechiae. A study by Tanghetti showed that the vacuoles contained melanin in samples taken after the therapy in darker skin, while the target chromophore had shifted to include hemoglobin in lighter skin types because vacuoles containing red blood cells with hemorrhage were found. However, there was no damage to surrounding cells or underlying structures in both skin type.[11] As the population seeking laser therapy becomes more diverse, it is important to understand phototype, ethnic, and racial variations in safety and overall therapy outcomes. Further exploration of this laser, mainly in colored skin is needed.

Conclusion

The picosecond laser with a 755-nm wavelength is effective and safe for facial rejuvenation in the skin of Indonesian patients. Photoaging-associated facial wrinkles, pigmentations, and textural irregularities can be improved by the picosecond laser without significant adverse events.

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Conflict of Interests

The authors report no conflicts of interest

Ethical Considerations

All patients signed the informed consent. Ethics approval was granted by the Dr. Soetomo General Academic Hospital Review Board in Surabaya, Indonesia.

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