Clinical Benefit of Combination Treatment with 1,550 nm Fractional Laser and a New Wavelength at 1,927 nm on Photorejuvenation in Asian Patients

You Jin Lee  
Jong Yoon Chung  
Jae Hyung Lee  
Jong Hee Lee  
Joo Heung Lee

Background and Objectives  
Fractional laser using a new wavelength of 1,927 nm is expected to work on superficial skin conditions, while a 1,550 nm fractional laser was proven to be effective in dermal remodeling. We administered the combination treatment using 1,550 nm with 1,927 nm in a single session to determine its clinical efficacy and safety in photorejuvenation.

Materials and Methods  
Patients who received combination treatment were analyzed. Two blinded assessors graded the degree of improvement using photographs based on a quartile scale [0-3]. Erythema and melanin index were measured on the same spot before and after treatment. Patients’ satisfaction and adverse effects were also reported.

Results  
A total of 25 patients were evaluated. Patients were followed up for up to 12 months (4.04 ± 2.78 months). The overall clinical improvement was 2.12 (Pigment improvement: 1.92 ± 0.84, wrinkle and skin texture; 1.66 ± 0.54). Melanin index showed a substantial decrease after treatments. One patient experienced post inflammatory hyperpigmentation, which subsided with administration of a topical bleaching agent after six months.

Conclusion  
Combination treatment with 1,550/1,927 nm may provide clinical benefit in Asian photoaged skin which contains a lot of pigmentation burden as well as wrinkles and other aging phenomenon.

Key words  
Combination treatment; Photorejuvenation
**INTRODUCTION**

Fractional photothermolysis is a new concept of treatment, in which precise arrays of microscopic treatment zones (MTZ) are produced in the dermis, stimulating a therapeutic response around them. Surrounding normal intact epidermis enables accelerated healing after treatments.1-3 Many studies have proven that this treatment modality can achieve desirable clinical results without serious adverse effects or longer downtime, which was the major limitation of ablative laser resurfacing.4-6

Nonablative fractional laser therapy at 1,550 nm was approved by FDA for the treatment of periorbital rhytides, skin resurfacing, acne, and surgical scars.5 It was also approved as an effective treatment modality for melasma and pigmented lesions.7,8 For the treatment of wrinkles, scars and other clinical conditions which require dermal remodeling, nonablative fractional laser treatment using 1,550 nm is a success without any doubt and lots of previous researches supported it.2,5,7 However, there have been controversies on its clinical safety and efficacy for pigmentary conditions and melasma. Several studies2,7,8 insisted its clinical benefit on melasma or dyspigmentation in Caucasian skin, while clinical application on pigmentation in darker Asian skin has still limitation.10-12

Recently, a novel 1,927-nm wavelength fractional laser has been developed and it was added to a 1,550-nm erbium:glass (Er:Glass) fractional device.13,14 This new wavelength at 1,927 nm has a higher absorption coefficient for water than conventional 1,550 nm erbium-doped fiber laser. This characteristics of wavelength implicates that the maximum depth of penetration at 1,927 nm would be about 200-300 μm, while a 1,550 nm wavelength can reach down to 1,400-1,500 μm into the dermis. From this profile, it can be assumed that this new wavelength at 1,927 nm can target epidermal processes such as pigmentation and dyschromia, while conventional nonablative fractional laser at 1,550 nm works better on wrinkles and scars.15

Photoaged skin is a condition showing a combination of wrinkles, tactile roughness, telangiectasias and dyspigmentation. When we consider the treatment of photoaging in Asian skin, dyspigmentation and postinflammatory hyperpigmentation always matters.4 The modality to treat skin pigmentation, texture and wrinkles at the same time, is a must to ensure patient higher satisfaction. Therefore, dermal remodeling with 1,550 nm fractional laser treatment as well as improvement of superficial pigmentation and skin tones targeted by 1,927 nm thulium fiber fractional laser in a single session can be a promising treatment modality especially for photorejuvenation in Asian patients.

This study was performed to evaluate the clinical benefit and safety of combination treatment with 1,550 and 1,927 nm fractional photothermolysis in Asian photoaged skin.

**MATERIALS AND METHODS**

**Subjects**

Patients who received 1,550 and 1,927 nm combination treatment for their photoaged skin were included in the study. All patients were treated by one laser expert in a single institution.

Cases and photographs were reviewed retrospectively using medical records under the approval of Institutional Review Board. Patients who had been treated with any fillers or botox injection, and other photorejuvenation procedures within prior 6 months before enrollment were excluded in the analysis.

**Treatment procedures**

After 30 minutes of topical anesthesia, patients were treated first with 1,550 nm on the whole face and 1,927 nm fractional laser was performed on top of it using Fraxel Re:Store DUAL (Solta Medical, Hayward, CA). The treatment settings for 1,550 nm were 30 mJ, treatment level 8 (total coverage 23%), 8 passes and only 4 passes of it were delivered. Afterwards, 1,927 treatment was performed with a fluency of 10 mJ, treatment level 3 (total coverage 30%), and 4 passes. If patients wanted more treatment, the second treatment session was performed after two months, in which treatment settings were adjusted according to the residual clinical condition. For example, patients who had more residual pigmentation, the treatment parameter of 1,550 nm was set same as the first treatment session. For 1,927 nm treatment, fluence was adjusted according to skin thickness of patients (5-10 mJ). The treatment level was set at 3 (total coverage 30%), and passes were set at 8 passes. When 1,927 nm fractional laser was applied at the 2nd treatment sessions, first 4 passes were done and after waiting for about 10 minutes with icepacks on the treated area, the rest 4 passes continued if mild scabs were not noticed or erythema was not intense enough. For patients with more wrinkles and skin roughness at the second treatment session, the same treatment parameter and settings as the first treatment session of 1,550 nm were applied. However, 8 passes were delivered on patients.
For 1,927 nm treatment, the parameter was set at the fluence of 5 mJ, treatment level 3 and 4 passes. A cooling device (Zimmer Elektromedizin Cryo 5 device, Zimmer Medizin Systems, Irvine, CA) was used to alleviate pain and discomfort during treatment procedures. After treatment, an icepack with a cooling mask was applied on all patients for 20 minutes. Patients were instructed to avoid sun exposure and use topical moisturizer containing tranexamic acid two or three times a day until microcrust peeled off naturally. They were also educated to put on a broadspectrum sunscreen. Patients were instructed to return according to the recommended follow-up regimen.

**Evaluation**

Photographs were taken at each visit. Two blinded assessor evaluated the degree of improvement using a quartile grading scale using photographs. They scored overall improvement of photoaged skin as well as pigmentation, and textures and wrinkles in detail (0 = worse or less than 25% improvement, 1 = 25-50%, 2 = 51%-75%, 3 = 76-100% improvement). Erythema and melanin index were measured on the most prominent area of both zygoma, using skin color measuring device (Mexameter, MX18, Courage & Khazaka, Electronic GmbH, Clogne, Germany) at every visit. Patients rated subjective satisfaction using a quartile scale (0 = not satisfied, 1 = satisfied, 2 = very satisfied, 3 = extremely satisfied).

Adverse events were documented (e.g. persistent erythema, edema, severe pain, crusting, infection, pigmentary changes, scarring).

**Statistical analysis**

Clinical data were compared using the Wilcoxon signed rank test. Paired t-test was used for the comparison of erythema and melanin index. Statistical analysis was performed with SPSS software version 19.0 (SPSS Inc., Chicago, IL). All tests were assessed at an $\alpha = 0.05$ significant level. $p < 0.05$ is considered to be statistically significant. Values were documented as means ± standard deviations.

**RESULTS**

A total of 25 healthy Korean patients (mean age: 51.5 years, standard deviation: 8.5 years, range: 43-72 years, M:F = 4:21) with Fitzpatrick skin types III-IV were included in the analysis. Twelve patients received two treatment sessions and the others underwent one treatment session. The follow up visit varied from 1 month to 12 months (4.04 ± 2.78 months).

Overall improvement in all patients was marked as 2.12 ± 0.75. Pigment improvement was evaluated as 1.92 ± 0.84 and wrinkles/textural smoothness as 1.66 ± 0.54. Patients who received two times of combination treatment appeared to show better clinical results. Patients’ satisfaction tended to be higher in patients treated twice, too (Table 1, Fig. 1, 2, 3).

Erythema and melanin index were measured in ten patients who received two treatment sessions. These ten patients were followed up for 4.70 ± 0.81 months after the second treatment. Baseline erythema index was 201.3 ± 37.2 and it dropped down to 180.2 ± 41.8 at 1 month after the first treatment. At last follow up, it was measured as 191.8 ± 43.7. Considerable reduction in melanin index after the first treatment was noticed (from 192.9 ± 28.3 to 150.2 ± 22.6). At last follow up after the second treatment,
it showed substantial improvement of pigmentation compared with baseline and after first treatment (138.0 ± 23.7) (Table 2).

Nineteen out of 25 patients reported that they were very or extremely satisfied with the treatment. One patient complained of transient pigment darkening after treatment and she did not want to get through another treatment session. She was advised to use topical 4% hydroquinone every night and her postinflammatory hyperpigmentation improved at 6 months follow up.

**DISCUSSION**

A lot of studies support fractional photothermolysis as an effective and safe treatment for photodamaged skin. Wanner et al reported that this nonablative 1,550 fractional laser worked on facial and non facial photodamage, rhytides and even dyspigmentation with low side effect profile. In the early era of fractional photothermolysis, it was expected that this fractional approach creates columns of thermal injury and melanin pigments are also successfully eliminated through these precise microscopic epidermal dermal necrotic debris (MEND) after treatment. Early studies focused on its clinical efficacy for dyspigmentation and even melasma. However, disappointing results were reported in pigmentedary condition especially in darker skinned patients. Wind and colleagues even protested that topical therapy with triple combination cream remains the gold standard treatment of melasma compared with fractional photothermolysis in a randomized controlled split face study.

Fractional photothermolysis using a new wavelength at 1,927 nm has been studied in recent years. Higher water absorption at this wavelength confers a greater ability to target superficial conditions such as pigmentation and dyschromia. Several clinical studies showed that it can offer favorable results on macular seborrhoeic keratosis, and melasma. Lee and colleagues demonstrated clinical improvement of photodamaged skin and melasma in Asian patients using 1,927 nm thulium fiber fractional laser. In their study, they reported that wrinkles, laxities and skin texture improved after treatment. However, the focus of clinical outcome was rather an improvement of pigmentation. Photoaged skin has many aspects including discrete pigmentary changes as well as rhytides, surface roughness and skin laxities which definitely need to dermal remodeling and deep tissue reaction. Therefore, we tried to figure out whether a combination using 1,550 and 1,927 nm fractional photothermolysis is safely applied in a single session for photorejuvenation in Asian patients. For setting the appropriate treatment parameter, a split face pilot study comparing 1,550 nm solo treatment with 1,550/1,927 nm combination treatment was performed ahead of this study.
This study showed this combination modality yielded low adverse effect profile on patients for photorejuvenation. We did not use higher coverage like 60-70% in previous studies because of possible risk of postinflammatory hyperpigmentation. Under the parameter and studies because of possible risk of postinflammatory adverse effect profile on patients for photorejuvenation. We did not use higher coverage like 60-70% in previous studies because of higher risk of postinflammatory hyperpigmentation in Asian skin. The results were performed the same treatment using exactly same devices and parameters on patients with photodamaged skin. When we applied intense pulsed light, the fluence was lowered by 10 to 15% compared with their study because of higher risk of postinflammatory hyperpigmentation in Asian skin. The results were not satisfactory at all. Three out of 4 patients returned with postinflammatory hyperpigmentation (data was not shown here). Kearney et al applied a treatment parameter of 1,550 nm fractional laser as 30 mJ- level 8 (23% coverage) -8 passes. Considerable erythema usually achieved after 1,550 nm fractional laser treatment with this parameter. Intense pulsed light application right after this treatment might increase the risk of postinflammatory hyperpigmentation in darker skinned patients. However, 1,550/1,927 combination treatment in this study showed rather safe results in Asian photoaged skin. Fractional photothermolysis using a wavelength at 1,927 nm did not respond to skin erythema unlike intense pulsed light. Therefore, it is assumed that patients with darker skin type can tolerate this combination treatment better. A combination of different lasers and light sources for concomitant treatments gives way to a potential area of advancement in the clinical field. Many dermatologists are performing combined treatments in their daily practices to enhance clinical outcomes, but little has been published until now. This study has its own value from this point of view. Although this was not prospective study or did not have any control like 1,927 or 1,550 single treatment, the result turned out very promising. In conclusion, the combination using 1,550/1,927 nm fractional laser in a single session may provide another safe and effect treatment modality for photorejuvenation in Asian patients. Prospective studies to validate its use or a comparative study between combination and solo treatment would be needed.

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