Clinical and Histological Results of Full Face Treatments with the 2,790 nm Pearl YSGG Laser System

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Background

Historically, cosmetic procedures resulting in superior clinical results required significant patient recovery times. In the mid 90's, CO_2 resurfacing gained popularity for its ability to create a significant zone of thermal damage in the dermis resulting in impressive improvements in skin texture and wrinkle reduction. However, patient downtime is typically 10-14 days and, if complicated by infection or hyperpigmentation, can last much longer. The demand for an ablative procedure with less downtime resulted in the development of Er:YAG (2,940 nm) "mini" laser peels. This procedure by design showed only superficial ablation of the epidermis but provided little thermal damage and limited cosmetic enhancement. Recently, fractional devices have gained popularity due to their ability to minimize the downtime and complications associated with traditional laser resurfacing. As these procedures treat only a fraction of the skin's surface, a drawback is the number of treatment sessions needed to achieve tangible cosmetic improvement.

In 2007, the Cutera Pearl with YSGG (2,790 nm) technology was launched. It represents the first FDA cleared device for cosmetic dermatologic use at this wavelength. The Pearl technology was developed to provide a combination of ablation and coagulation to maximize the thermal effects of the procedure while minimizing patient downtime, the number of treatments, and the amount of pain. This paper reports preliminary results from a study to evaluate the safety, efficacy and histological effects from treatments with this new device.

Methods

This institutional review board approved study consisted of 8 subjects, skin types I through III, aged 32 to 77 years, with mild to moderate photodamage. Six of the subjects were females and 2 were males. Informed consent was obtained from each subject. Patients received two full face treatments, three weeks apart, with a 2,790 nm YSGG laser system after first having pre-auricular test area treatments that were observed three days after treatment. The test areas were used to assess the depths of ablation and coagulation as well as to evaluate the short term response to treatment. Control and test area biopsies were taken of each subject immediately after the test area treatments. Standardized photographs were taken at each visit.

Full face treatments were performed at least 30 minutes after application of a topical anesthetic with 5% lidocaine. After removal of the topical anesthetic with gauze, an acetone wipe was performed to ensure that any remaining anesthetic was removed. We found in previous work that any remaining topical anesthetic could absorb the laser energy, reducing the impact on the skin. Each subject was treated with a single pass of the full face down to the jawline. Pulses were applied contiguously using scan patterns consisting of 6 mm diameter laser pulses with an overlap of 20% to avoid any untreated areas. The pulse duration was 400 microseconds. The fluences ranged from 1.5 to 3.5 J/cm^2 for the test spots and 1.5 to 3.0 J/cm^2 for the full face treatments (average of 2.2 J/cm^2). The treatment time for a full face ranged from 10 to 15 minutes.

Results

At this time, all subjects have received both treatments and final follow-up and evaluations are underway.

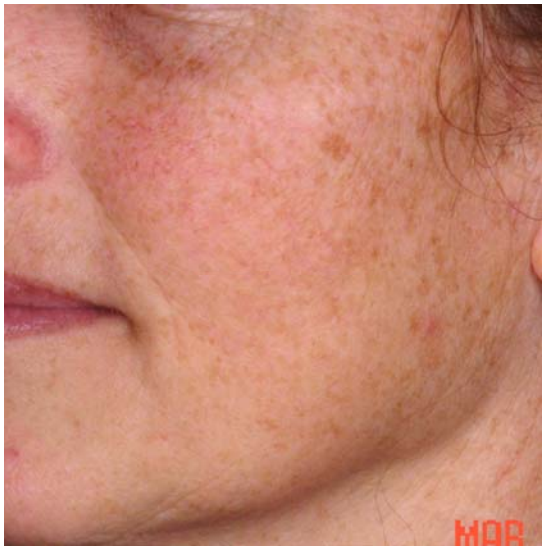
Histological analysis of the biopsies taken immediately after the test area treatments demonstrated a zone of ablated tissue superficial to a thicker zone of thermal necrosis. The zone of thermal necrosis was approximately twice as thick as the zone of ablation. The total depth of these two zones ranged from approximately half of the epidermal thickness at a fluence of 1.5 J/cm^2 to the full epidermal thickness at 3.5 J/cm^2.

This coagulated tissue was left on the skin after treatment to serve as a natural protective layer. Subjects were instructed to keep the treated area covered with Aquaphor or a similar ointment until this tissue sloughed off. For most subjects, this occurred on the third or fourth day after treatment. All subjects were followed at 1, 4 and 7 days after the first treatment. All subjects experienced mild to moderate erythema. Some subjects experienced mild to moderate edema and one subject developed contact dermatitis, which has resolved.

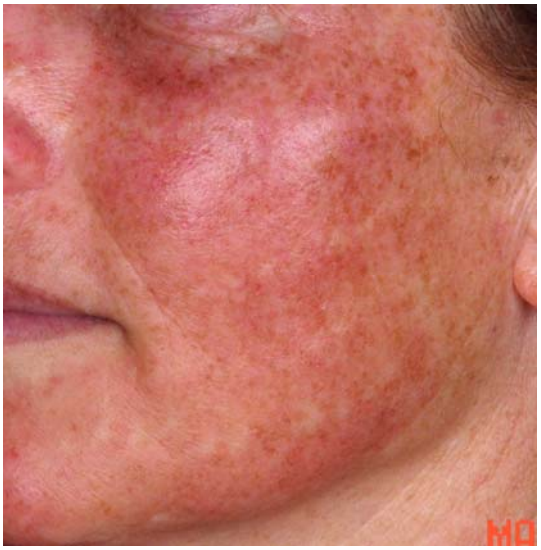
Six of the eight patients have completed the follow-up visit at 1 month after the second treatment including providing feedback on their experience. The treatment was well tolerated by all subjects. All of the subjects rated the discomfort during treatment as either mild or moderate. Except for the subject that developed contact dermatitis, all subjects indicated that discomfort had resolved by the first or second day after treatment and that they were comfortable returning to work between one day and four days after treatment.

All six of the subjects reported improvement in overall skin tone and texture and as well as an improvement in brown spots. Three of five subjects reported improvement in fine lines.

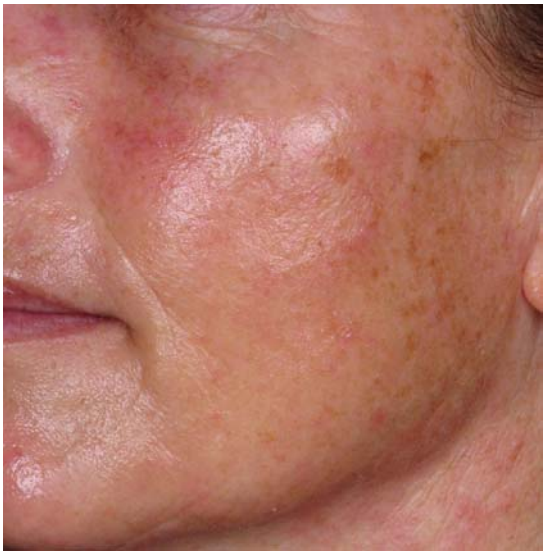
The photos below show the short term response and longer term results for a 50 year old female who received 2 treatments, three weeks apart, each with a single pass at a fluence of 2.1 J/cm^2 and a pulse duration of 0.4 ms.



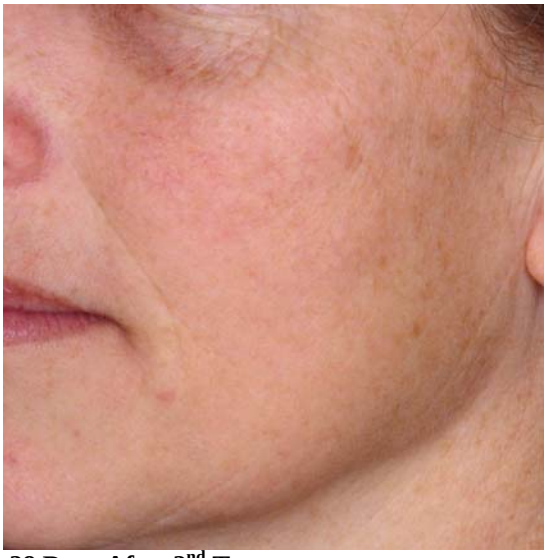
Pre Treatment



1 Day Post Treatment



4 Days Post Treatment



28 Days After 2nd Treatment

Discussion

This paper describes the preliminary clinical trial results of a new wavelength (2,790 nm) for skin rejuvenation procedures. The water absorption coefficient for this wavelength of light is greater than that of a CO_2 laser but less than that of an Erbium YAG laser. It was speculated that this would allow for finer control of the procedure depth as compared to a CO_2 laser, while providing a greater residual thermal effect than an Erbium YAG laser. The histology supports this contention as the ratio of the depth of coagulation to ablation always exceeded unity. The coagulated layer acts as a natural dressing and appears to provide patient comfort and protection in the early healing period. Improvement in brown spots, skin tone and texture, and fine lines was reported with a limited amount of downtime.