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SmartSkin®

CO_2 LaserSkinRenewal™ Workstation

case study

SmartSkin: Laser Depth of Penetration

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OVERVIEW AND OBJECTIVES

Several studies support the clinical efficacy of the SmartSkin fractional CO_2 technology for the purposes of skin rejuvenation.[1] By sparing tissue, the fractional delivery of energy provides advantages over fully ablative skin resurfacing, including less post treatment downtime and fewer side effects. In addition, studies have been performed to measure depths of penetration for fractional resurfacing devices at various power/fluence levels for a single pulse of energy. [2, 3]

The objectives of this case study were to first identify the depth of penetration and the attributes of the wound through histology, for stacked pulses utilizing the MultiPulse delivery system and through a split face patient treatment, was to understand the safety, efficacy, clinical outcomes, and pain management by comparing a double pulse treatment with two passes of a single pulse.

This study outlines the histological findings of depth penetration in human ex-vivo facial skin and the effects of using the SmartSkin MultiPulse delivery system with a split faced patient treatment.

PATIENT HISTORY

Patient

The patient was a 67-year-old female with Fitzpatrick II skin type, presenting rhytides of the perioral and periorbital areas, and diffuse solar elastosis of the face.

MATERIALS AND METHODS

Pre-Op Instructions and Prep

Patient was advised to avoid sun exposure prior to treatment, tweezing, or electrolysis. Patient was prescribed Valtrex and Cipro 500 mg bid for a 10-day course, both started the day prior to the procedure. The patient was instructed to wear no makeup on the face, eyes, or lids the night before and the day of the procedure. The patient's face was cleansed with Septicol and examined for signs of cold sores or infections. A topical anesthetic ointment comprised of a 20% combination lidocaine/prilocaine and .25% phenylephrine was then applied on the intended treatment sites and occluded for approximately 30-45 minutes. The topical anesthesia was wiped off before the treatment was administered.

Treatment

The SmartSkin CO_2 laser system was used to generate an array of microscopic treatment zones. The patient's right side of the face and neck were treated with one pass of the MultiPulse setting at two. The left side was treated with the MultiPulse setting off, delivering two passes sequentially.

The laser scanner was operated in the super pulse setting and scan mode at normal. Repeat was set at 2.0 seconds. Ratio was 10:10 and size 100% which covered each laser treatment site approximately 1.5 cm X 1.5 cm. Pulse energy was set at 20 watts. Spot density/pitch was set at 500 microns and scanning dwell time was 500 microseconds.

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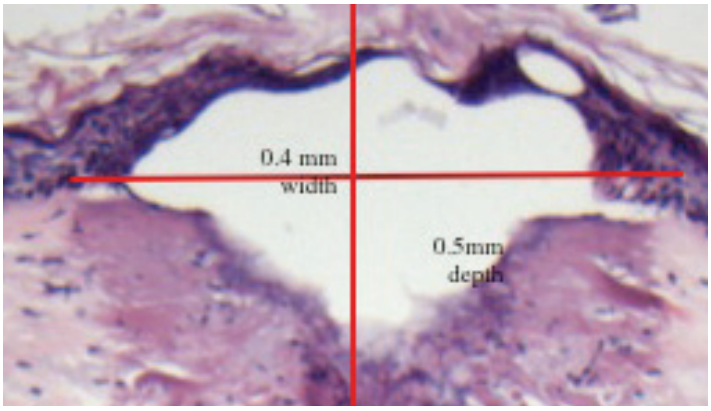
	Total Depth	Total Width	Ablation Zone	Thermal Coagulation Zone
1 Pulse	**.5** mm	**.4** mm	**. 2** x **.3** mm	**.3** x **.1** mm
2 Pulses	**1.1** mm	**.45** mm	**.9** x **.3** mm	**.2** x **1.5** mm
3 Pulses	**1.75** mm	**.6** mm	**1.4** x **.3** mm	**.35** x **.3** mm
4 Pulses	*	*	**2.5** x **.75** mm	n/a
5 Pulses*	*	*	*	n/a

TABLE 1. Table 1-Depth of Penetration Findings Ex-Vivo

* Extended through dermis into fat



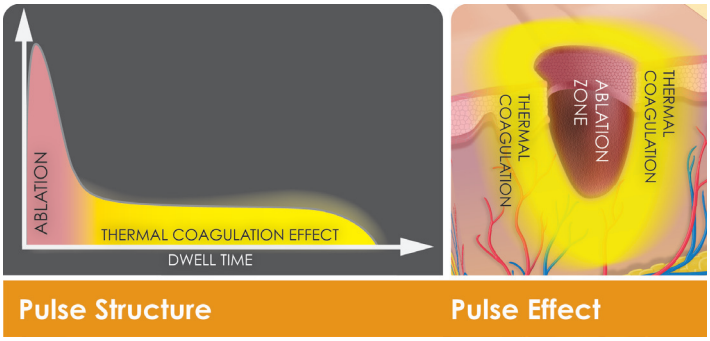


FIGURE 2. (above) SmartSkin Pulse Structure and Effect

FIGURE 1. (left) Depth of Penetration 1 Pulse 30 watts, 2000 dwell, 1000 pitch

Post-Op Treatment

Immediately post-op, the treated area was dressed in an ointment comprised of 50% Vaseline and 50% Cortisone-10 liberally. The patient was instructed to remove the ointment after three hours by soaking the face with cool water and a soft washcloth or cotton balls. The treated skin should then be pat dry and reapplied with the 50/50 Vaseline and Cortizone-10 ointment liberally. The post-op regime should be repeated every three hours for a minimum of five days and followed with at least SPF 15 sunscreen at all times. The patient was advised to sleep on her back with the head elevated for a period of one week, and instructed to avoid strenuous exercise for two weeks to prevent sweating.

RESULTS

The laser system created a microscopic pattern of ablative and thermal injury to both treated sides. The side treated with the MultiPulse setting at two pulses produced a more aggressive treatment, as compared to the side treated with one pulse, with two passes through observation and supporting histology. On day one post-op, the side treated with the Mulitpulse displayed more crusting and oozing, suggesting a deeper depth of penetration. (Picture 3)

HISTOLOGICAL FINDINGS

Microarrays of ablative and thermal injury were created in fresh ex vivo human facial skin irradiated with each of the MultiPulse settings from pulse 1-5. The samples were sectioned into slices and then stained with Hematoxin and Eosin (H&E). The pulse energy was delivered at 30 watts, with a dwell time of 2000 µs, and a density/pitch of 1000 µm. As illustrated in Figure 1, the photomicrographs demonstrate zones of ablation that are surrounded by areas of thermal tissue coagulation spanning the epidermis and part of the dermis. The lesion dimensions represent the maximum depth and width of the outermost border of the coagulation zones. The histology demonstrates the following:

1. The controlled deliveries of energy can be created with variable depths and widths and correlate with the amount of energy delivered utilizing the MultiPulse delivery system.
2. The zones ranged from a depth of .5 mm at one pulse to greater than 2 mm and extended into the fat at a MultiPulse setting of 5. (See Table 1.)
3. Each pulse demonstrates an increase in penetration (vertical) with minimal increase to the width (horizontal) of the wound. (See Table 1)

PICTURE 1. Right Side of Face treated with MultiPulse, left side two passes-single pulse

PICTURE 2. Right Side of neck treated with MultiPulse, left side two passes-single pulse

4 The photomicrographs demonstrate an ablation zone as well as a significant thermal coagulation zone. The thermal coagulation zone is considered to be the foundation of the healing process and collagen remodeling. The formation of this type of wound is caused by the properties and structure of this specifically designed wavelength. The design creates an initial high peak power which causes rapid ablation. This is then followed by a lower powered dwell that maximizes the thermal coagulative zone. (See Figure 2)

CONCLUSIONS

Through histological analysis, the MultiPulse delivery system demonstrated the capability to provide the maximum amount of penetration required for fractional ablative resurfacing. Secondly, the pathology demonstrated that the lesion dimensions showed a significant difference in vertical (depth) penetration with the addition of pulses, while minimally demonstrating an increase horizontally (width). Lastly, the histology showed a suitable thermal coagulation zone which is the foundation of neocollagenisis and faster recovery

Physician observation post treatment (Pictures 1 and 2) found a denser display of ablative zones and graying immediately post-op to the side treated with the MultiPulse compared to the side treated with the double pass. 1 day post-op demonstrated pinpoint bleeding and oozing (Picture 3). Post treatment downtime for the side treated with the MultiPulse was also 2-3 days longer than the double pass (Picture 4). At 1 month (Picture 5), the patient reported better skin tightening and skin tone to the side treated with the MultiPulse. The patient will be reexamined at a six month interval, which will allow for additional collagen remodeling and any changes in efficacy will be further reported.

PICTURE 3. 1 day post-op. More pinpoint bleeding, crusting, and oozing on right side.

PICTURE 4. Five days post-op. Trace erythema still visible on right cheek

PICTURE 5. Pre-Op and One Month Post-op

REFERENCES

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2. Basil Hantash, Vikramaditya Bedi, Bhumika Kapadia, Zakia Rahman, Kerrie Jiang, Heather Tanner, Kin Foong Chan, and Christopher Zachery. In Vivo Histological Evaluation of a Novel Ablative Fractional Resurfacing Device. Lasers in Surgery and Medicine 2007; 39 (2): 96-107.
3. Basil Hantash, Vikramaditya Bedi, Kin Foong Chan, and Christopher Zachery. Ex Vivo Histological Characterization of a Novel Ablative Fractional Resurfacing Device. Lasers in Surgery and Medicine 2007; 39 (2): 87-95.

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