

Laser CO₂ and Radiofrequency: effective synergy for skin rejuvenation

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SUMMARY

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The CO₂ Laser Resurfacing, traditional and fractional, is now established and widely used method for treatments of photo-rejuvenation and scarring.

The ongoing and innovative scientific research has developed a new instrument which coupled the CO₂ Laser System and a Non Ablative Bipolar Radio-Frequency to obtain at same time a reduction of down-time of treatments and an improvement of performances. Aim of this study is to analyse this new Laser, called SmartXide² (DEKA M.E.L.A. S.r.l., Italy), that should rewrite the CO₂ Laser technique crossing a new boundary for surgical lasers in the fields of dermatology, aesthetic medicine and plastic surgery for treating complex skin disorders such as acne scars, ageing and sagging skin.

KEY WORDS: Laser CO₂, Non Ablative Radio-Frequency, Synergy for skin rejuvenation.

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Introduction

A new system has been added to the fractional CO₂ Laser source for deep heating of the skin by using Non-Ablative Radio-Frequency electrodes (RF) that make it possible to safely and effectively target the different skin layers of the dermatological disorders to be treated.

This new fractional device, by exploiting the simultaneous and modular synergy of the CO₂ Laser and Radio-Frequency, makes it possible to induce various biological effects on the treated tissue that range from dermal stimulation for the production of new collagen, to regeneration of tissue texture, enhancing smoothness and skin-tone.

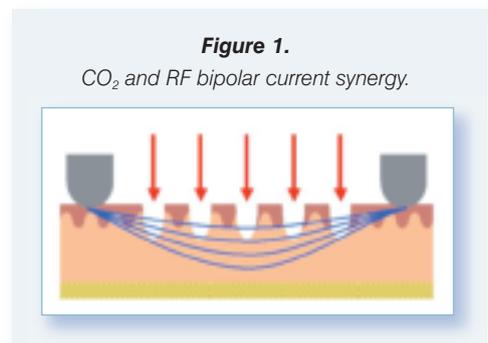
The versatility of this system has been further improved by the innovative Pulse Shape Design Technology with its new laser pulse shapes (Smart-Pulse, D-Pulse and H-Pulse), never before applied in laser surgery.

The combination of these two sources (CO₂ Laser and Non-Ablative Bipolar Radio-Frequency) delivered in “almost” simultaneous mode set the stage for obtaining synergism and making it possible to achieve a twofold result:

- enhanced efficacy of treatment due to the synergy of the two methods;

- reduced healing times, side effects and possible complications.

The CO₂ laser energy pre-heats the target tissue, reducing impedance and allowing the RF to reach the same target more efficiently, more uniformly and at greater depth (Figure 1).



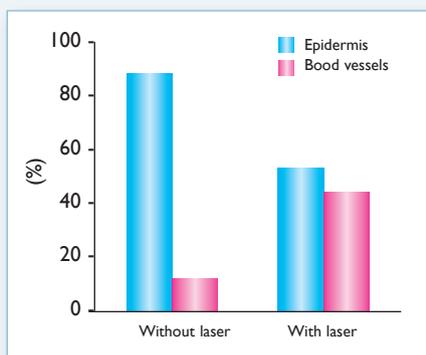
In the presence of the two energies, the action mechanism can be summarised as follows:

- CO₂ laser on the skin induces hyperaemia in the papillary dermis;
- the hyperaemia and consequent rise in temperature and reduction in the relative tissue

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Figure 2.

Distribution of the RF current in the tissues
(Courtesy of PhotoBioLab - El. En. Group).



impedance, together with the special emission from the handpiece, allow a constant passage of the RF current through the blood vessels with a 40% increase in the energy administered;

- besides enhancing the treatment efficacy, the deep hyperaemia generated by the RF also increases the general hyperaemia for some days, leading to a more durable effect over time;
- the presence of persistent hyperaemia also accelerates the tissue healing process.

From a series of tests on the forearm, an almost 40% reduction was observed in clinical healing times and relative downtime. These observations were later confirmed by microscope studies to assess the expulsion times of the fibrin microplugs (DOTs).

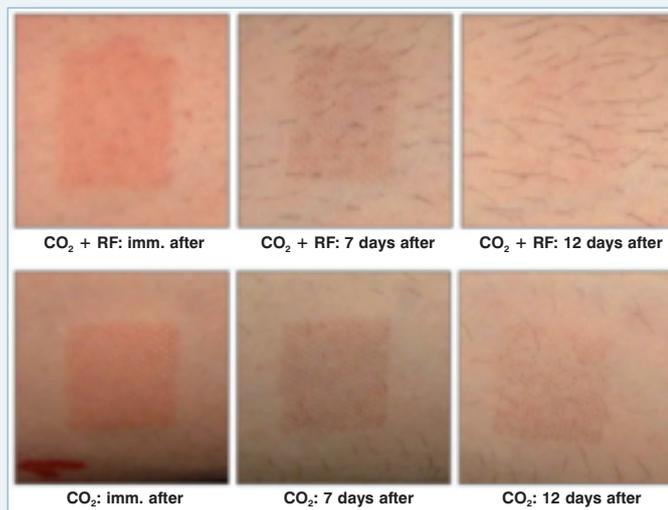
In short, the combination of the two methods leads to several significant beneficial effects:

- transfer of the energy from the surface layers to the deeper layers in a considerably more uniform manner, giving rise to enhanced treatment efficacy;
- confinement of the superficial hyperaemia, limiting the downtime and potential side effects and related complications;
- reduced healing times.

This was also confirmed by immunohistochemical investigations of in vivo studies of ovine tissue to assess the expression of several cytokines such as Ki67 (indicative of cell proliferation

Figure 3.

Comparison between CO₂ and CO₂+RF on forearm
(since healing times on the arm are longer than those of the face, the value to be considered is the relative reduction, not the absolute value).



in progress), Factor VIII (indicative of neoangiogenesis in progress) and others.

These studies too demonstrated how the combined use of RF and CO₂ Laser induces deeper and better diffused and distributed biostimulation of the tissue with acceleration in tissue turnover.

Materials and methods

The study was conducted in a private laser dermatological practice. From February to September 2011 a total of 10 patients were enrolled (5 males and 5 females) aged 17 to 60 (mean 35 years), 2 with phototype II, 6 with phototype

Table 1.

Laser and RF parameters used in SmartXide².

Dwell time	500 - 1000 μ s
Spacing	500 μ m
SmartStack	from 1 to 3
Scanning mode	SmartTrack
Pulse Mode	S-Pulse for Scars & Refreshing of the Face; D-Pulse for Facial Ageing
Energy per DOT	7.5 mJ for Refreshing 15 - 45 mJ for all other Tx's
RF power	20-30 W
RF time	2-3 sec



Before treatment



3-day follow-up



6-week follow-up

Figure 4. Acne scars:
Right side: CO₂ only - Left side: CO₂+RF - CO₂: S-Pulse, 1000 μs, 500 μm, Stack 3, 45 mJ x DOT - RF: 30W, 3 sec.
The patient has less irritation and bleeding and fewer scabs on the left side.



Before treatment



2-day follow-up



2-week follow-up

Figure 5. Refreshing:
Right side: CO₂ only - Left side: CO₂+RF - CO₂: S-Pulse, 500 μs, 500 μm, Stack 1, 7,5 mJ x DOT - RF: 20W, 2 sec.
The patient has less erythema and oedema immediately after Tx and significantly less irritation and discomfort 2 days after Tx on the left side.



Before treatment



Immediately after treatment



2-day follow-up



2-day follow-up

Figure 6. Acne scars:
Right side: CO₂ only - Left side: CO₂+RF - CO₂: S-Pulse, 1000 μs, 500 μm, Stack 2, 30 mJ x DOT - RF: 20W, 2 sec.
There are less irritation and bleeding and fewer scabs on the left side of the patient's face.

III, and 2 with phototype IV (*Fitzpatrick's Skin Phototypes*).

Seven patients had facial acne scars; 1 patient had acne scars on the back; 1 patient was treated for refreshing of the face and 1 for facial ageing. After obtaining informed consent from all patients, a "Split-Face" treatment with SmartXide² was carried out programmed as follows:

- right side: CO₂ laser only;
- left side: CO₂ laser (using the same parameters as the right side) + Radio-frequency.

All patients were instructed to:

- take Acyclovir tablets 400 mg four times daily for 4 days, starting the day before Tx;
- avoid applying moisturizers the day before Tx;
- avoid make-up the day of Tx;
- apply after Tx, several times a day and for a week, a cream with hyaluronic acid and usnic acid;
- apply Vaseline every night from the third day;
- use only cleansing milk and cotton pads, not water, for cleansing;
- be able to make-up after the third day;
- avoid sun exposure and use sunscreens for at least one month after Tx.

An hour before the treatment was applied to all patients an anesthetic cream (4% prilocaine, 6% lidocaine, 6% tetracaine).

Photographs were taken, using a digital camera *Pentax X 90 Reflex*, before Tx, immediately after Tx, 2-3 days after Tx and at 2, 6 weeks follow-up.

Results

Immediately after treatment there was slightly less erythema on the side treated with Laser CO₂+RF.

Two to three days after treatment, the side with combined radio-frequency showed much less irritation, bleeding and scabs than the side treated with CO₂ laser only. All the patients reported that they felt less "discomfort" on the left side.

The side treated with the CO₂ Laser + RF combination showed "Restitutio ad Integrum" within an average of 5 days, while the side treated with

CO₂ laser alone healed within an average of 7 days.

At follow-up, the side treated with CO₂ Laser + RF showed better results over the weeks due to enhanced skin tone and compactness.

No long-term side effects were observed.

Conclusions

Over recent years there has been a huge increase in the demand for laser treatment for various kinds of scars and the signs of ageing, or simply to improve skin texture with Refreshing treatments. At the same time, however, there has also been an increase in the "logistic" requirements of patients. In a world where we all are engaged in intensive relational life, it is increasingly difficult to "take time off" to undergo temporarily disabling procedures.

The introduction of the fractional CO₂ technology which takes these important aspects into due consideration, has now considerably reduced the downtime of these treatments as well as side effects and possible complications.

Today, with the introduction of this new system combining emission of CO₂ Laser and Non-Ablative Bipolar Radio-Frequency, it is possible not only to reduce downtime and related recovery times but, even more important, to improve the performances of the treatments.

The integration of these two energies appears to intensify the thermal effects on the treated tissues, guaranteeing better results in less time and with fewer sessions, without increasing risks or side effects.

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