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Fractional Laser Skin Resurfacing with SmartXide DOT. Initial Results

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INTRODUCTION

The natural ageing process together with exposure to the sun and pollution leads to a gradual deterioration of the skin's structure and function. This is mainly evident at the level of the epidermis and the upper papillary dermis, with a tissue laxity and skin that appears more lined, often accompanied by telangiectasias, wrinkles, and dark spots [1,2].

Resurfacing with ultra-pulsed CO_2 has always been considered the first choice of treatment for rhytids and photo-damaged facial skin [3–12]. However, due to the lengthy recovery times and frequent complications [13,14], very few patients agree to undergo this type of operation [15,16]. Besides the usual recovery time required for oedema, burning, scabs and erythema which may often last for months [17,18], there is also a high incidence of complications connected with hyper-and hypo-pigmentation, scarring, HSV infection, outbreaks of acne, milia formation, and dermatitis [19–24].

Over recent years, the market has therefore been orientated towards less invasive and less problematic systems and methods. This has led to a wide-scale production of a myriad of non-ablative devices for reducing wrinkles and improving photo-damaged skin with the consequent passing over from "skin resurfacing" to "skin rejuvenation".

However, a critical review of the literature inherent to these methods has revealed that in terms of efficacy, none of the results obtained with these non-ablative methods can be compared with the resurfacing results achieved with the CO_2 laser [23–27]. Moreover, these types of treatment are usually quite expensive for the patient, the devices themselves are also costly for the medical practitioners, and the results obtained are not always satisfactory.

This situation has stimulated the search for new methods and protocols that are more efficient in combining quick recovery and minimal post-op risks with greater treatment efficacy.

The advent of Fractional Photothermolysis, initially introduced with non-ablative methods, has given rise to the development of a new method that manages to effectively combine all the needs of both medical practitioners and patients, and namely, the Fractional Laser Skin Resurfacing (FLSR) with CO_2 laser [28–30].

Various CO_2 lasers with fractioned emission are currently available on the market. Despite the fact that all these systems are based on the same principles, they present significant differences with regard to output power, dwell-time, distance between the dots, varying scanner shapes and the laser beam profile. These differences may produce clinical results that differ greatly between one device and another.

MATERIALS AND METHODS

A CO_2 laser system called SmartXide (Deka, Florence, Italy) that works with a scanner in DOT mode has been used in each of the cases presented in this article. The SmartXide DOT system, which is a CO_2 laser with 30-watt maximum power in CW, is capable of emitting high energies in pulsed mode. In order to carry out fractioned treatments, a new pulsed emission mode called SmartPulse has also been developed. The first part of this new mode consists of a high peak power pulse that allows for rapid ablation of the epidermis and the first layers of the derma, while the second part of the pulse has low peak power allowing for targeted heating of the deeper areas of the skin (Fig. 1). The laser beam is focussed and positioned on the adjacent dots by means of a special scanner (DOT mode). The user is also able to set the most important features of the emission, such as power, dwell-time, shape and size of the area to be treated, and the distance between the dots.

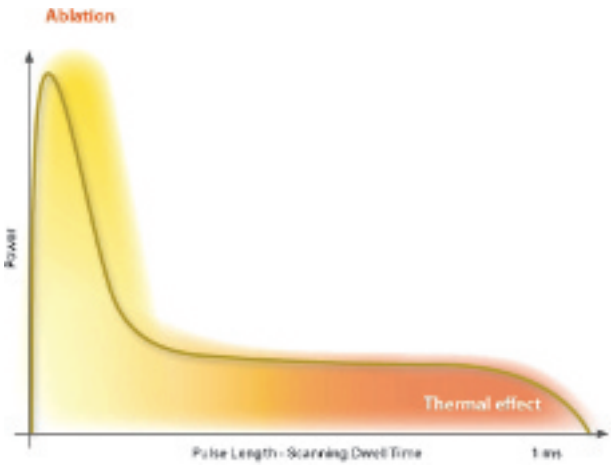


Figure 1. SmartPulse laser emission.

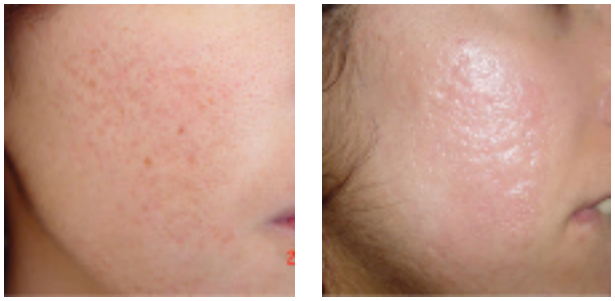
All patients enrolled in this preliminary trial were subjected to one or more treatments with the SmartXide DOT system. The interval between the sessions varied between 20 and 40 days. The objective of this initial trial was to highlight the versatility of the SmartXide DOT system in the treatment of wrinkles, skin laxity, epidermal and dermal pigmentation (including melasma), and hypertrophic scars. Additional trials are underway for enabling a careful examination of each of these treatments on a higher number of case studies. The results have only been examined visually

with a follow-up varying between one month and three months after the last treatment.

RESULTS

The SmartXide DOT fractioned system has been used in this trial for verifying its effectiveness in various treatments at both an epidermal and dermal level.

The first case concerns the treatment of acne scars on the cheeks of a 24 year-old girl. Already after only one treatment a reduction in the fibrous part of the scars was observed as well as a decrease in the associated pigmentation and dilatation of the pores. The parameters used were 30 W, a distance of 1,000 μm between spots, and 2 ms dwell time, corresponding to a dose of 3.3 J/cm^2 (Fig. 2).



(A) *(B)*

Figure 2. Acne scars. Pre and post 1 session with Smartxide DOT 30W, 1,000 μm distance between spots and 2 ms dwell time.

In the second case a 32 year-old man was treated for a keloid on his chest. Aggressive treatments were also preferred in this case (30 W, 800 μm, 2 ms and a dose of 4.5 J/cm^2) due to the marked fibrotic component. After two treatments 30 days apart the results were totally satisfactory (Fig. 3).

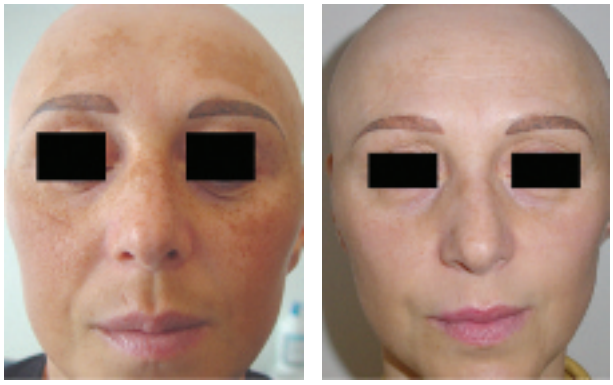
(A) *(B)*

Figure 3. Keloid on chest. Pre and post 2 sessions with Smartxide DOT 30W, 800 μm distance between spots and 2 ms dwell time.

In the cases of pigmentation, the treatment must have lower fluences, such as 15 W, 500 μm and 300 μs, corresponding to a fluence of only 0.6 J/cm^2. All these cases gave more than satisfactory results although in the case of the melasma the sessions naturally had to be repeated 5 or 6 times (Figs. 4, 5). The fluence was increased to 7.1 J/cm^2 (30 W, 300 μm, 1 ms) when the lesion showed considerable thickening, as illustrated in Fig. 6.

(A) *(B)*

Figure 4. Epidermal pigmented lesion. Pre and post 1 session with Smartxide DOT 15W, 500 μm distance between spots and 300 μs dwell time.



(A) *(B)*

Figure 5. Melasma. Pre and post 5 sessions with Smartxide DOT 15W, 1000 μm distance between spots and 300 μs dwell time.

(A) *(B)*

Figure 6. Epidermal Nevus. Pre and post 1 session with Smartxide DOT 30W, 300 μm distance between spots and 1 ms dwell time.

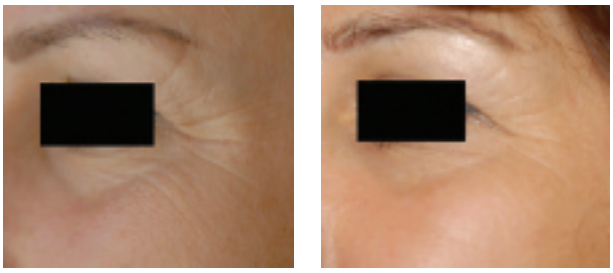
In the case of skin lines, the best treatment was obtained using an intermediate fluence (30 W, 500 μm, 1 ms, 4.1 J/cm^2) for as many as 4 sessions. In this case it was possible to keep the erythema under control, limiting it to a few days. In all cases the results were excellent from both a dermatological and a cosmetological point of view (Figs. 7, 8).

DISCUSSION

The SmartXide CO_2 laser allows for carrying out FLSR treatment by using the scanner in DOT mode. With FLSR

(A) *(B)*

Figure 7. Perilabial wrinkles. Pre and post 1 session with Smartxide DOT 30W, 500 μm distance between spots and 1 ms dwell time.



(A) *(B)*

Figure 8. Periocular wrinkles. Pre and post 1 session with Smartxide DOT 30W, 500 μm distance between spots and 1 ms dwell time.

the epithelial damage caused is less dramatic than that caused by the traditional ablative techniques. A part of the tissue remains intact during the treatment and acts like a natural bandage. The skin healing process is much faster compared to that with the Traditional Laser Skin Resurfacing (TLSR) techniques (Fig. 9). The areas treated are in fact surrounded by portions of intact tissue that help heal the damaged areas by providing new cells. The following down-time is therefore considerably reduced. Moreover, erythema is moderate and allows the patient to apply makeup immediately after the operation (Fig. 10). As illustrated in Fig. 11, the procedure the patient has to undergo is far better

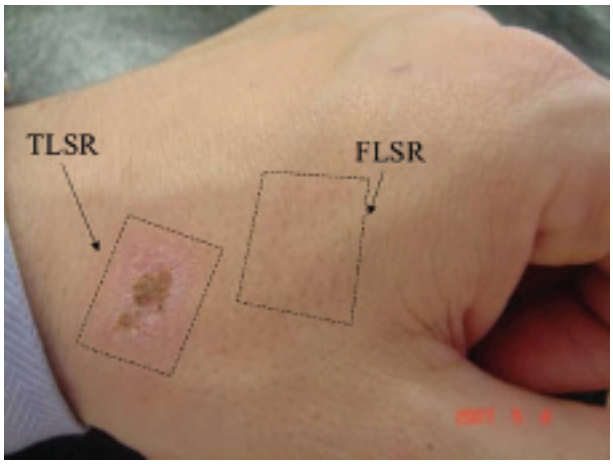


Figure 9. Comparison between TLSR (30W, Standard Mode, 200 μs) and FLSR (30W, DOT Mode, 2 ms, 1000 μm) effect, 1 month after the test.

Figure 10. Erythema 24 hours after DOT treatment with 30W power, spacing 1000 μm spacing and 2 ms dwell time.

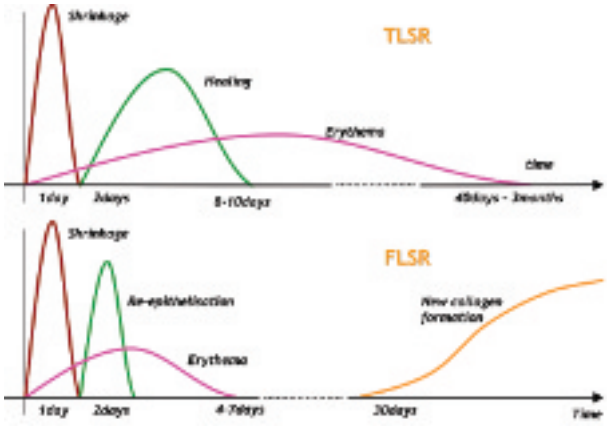


Figure 11. Recovery process comparison between TLSR and FLSR.

in the case of FLSR treatments compared TLSR. The re-epithelisation is greatly accelerated thanks to the limited epidermal damage and also begins on the first day. This aspect is fundamental for limiting the serious complications associated with every epidermal re-epithelisation process. The shorter the time required for forming a new epidermis, the lower the risk of bacterial or viral infections of the exposed derma. Another remarkable advantage is the reduction of erythema associated with the treatment, both in terms of absolute intensity and duration. This aspect is vitally important for reducing the period of social exclusion imposed by the other traditional methods.

CONCLUSIONS

The SmartXide DOT CO_2 laser has proved to be an extremely versatile instrument in dermatology. The results obtained are excellent and in nearly all cases have given rise to full patient satisfaction. The wide range of possibilities offered by modulating the laser scanner allows for adapting the treatment to the different features and expectations of each individual patient.

By using the DOT mode, downtime is minimal and the moderate erythema allows the patient to use appropriate makeup immediately after the operation.

The incidence of the typical side effects of TLSR is negligible provided the patient follows the simple recommendations given after the operation.

We established in this preliminary trial that the dose ranges differ in the case of superficial pigmented lesions (equal to or less than 1.0 J/cm^2), wrinkles (from 2 to 5 J/cm^2) and pronounced fibrotic lesions (over 6 J/cm^2).

For all these reasons, the treatment with SmartXide DOT represents a valid aid in dermatology without any of the negative complications involved in the conventional ablative and non-ablative systems.

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