**SCIENTIFIC PAPER – ABSTRACT**

**Eyelid skin tightening: a novel 'Niche' for fractional CO₂ rejuvenation.**


**Background:** The periorbital area is a barometer of chronologic and environmental age for which patients usually seek rejuvenation; fractional CO₂ laser plays a key role among the variety of available dermatologic treatments.

**Objectives:** The purpose of this study is to evaluate the efficacy and safety of Fractional CO₂ laser in eyelid tightening and periorbital wrinkles.

**Methods:** Forty-five patients received a range of 2-3 treatments in the upper, lower eyelids and periorbital area with a fractional laser device. Photographs were taken before and after each treatment and 2 weeks, 4 weeks, 3 months, 6 months and 12 months after the final treatment. The results were judged by three dermatologists who had not taken part in the treatments.

**Results:** One year after the last laser session, all patients showed global improvements in eyelid skin tightening: five patients (11.1%) achieved excellent improvement, 11 patients (24.5%) marked improvement, 15 patients (33.3%) moderate improvement and 14 subjects (31.1%) slight improvement. At the 1-year follow-up, the percentage of subjects with a lift in their eyebrows and consequently a widened palpebral fissure was 82.2 (37 patients), whereas 17.8% (eight patients) showed no eyebrow elevation. Conclusions: Fractional CO₂ laser treatments allow dermatologists to achieve notable improvements in eyelid skin tightening, and eyebrow elevation safely and without significant side-effects.

**Highlights of Thirty-Year Experience of CO₂ Laser Use at the Florence (Italy) Department of Dermatology**


The CO₂ laser has been used extensively in dermatological surgery over the past 30 years and is now recognised as the gold standard for soft tissue vaporization. Considering that the continuous wave CO₂ laser delivery system and the newer “superpulsed” and scanned CO₂ systems have progressively changed our practice and patient satisfaction, a long range documentation can be useful. Our experience has demonstrated that the use of CO₂ laser involves a reduced healing time, an infrequent need for anaesthesia, reduced thermal damage, less bleeding, less inflammation, the possibility of intra-operative histologic and/or cytologic examination, and easy access to anatomically difficult areas. Immediate side effects have been pain, erythema, edema, typically seen with older methods, using higher power. The percentage of after-treatment keloids and hypertrophic scars observed was very low (~1%) especially upon the usage of lower parameters. The recurrence of viral lesions (condylomas and warts) have been not more frequent than those due to other techniques. Tumor recurrence is minor compared with radiotherapy or surgery. This method is a valid alternative to surgery and/or diathermo coagulation for microsurgery of soft tissues. Our results are at times not consistent with those published in the literature, stressing the concept that multicentric studies that harmonization methodology and the patient selection are vital.
Fractional CO₂ laser for the treatment of acne scars.


**Background:** Numerous reports have been published on skin rejuvenation by the so-called fractional laser device that delivers a laser beam in a dot form over a grid pattern.

**Aims:** In this study, we characterized the effects of a fractional CO₂ laser on atrophic acne scars at the clinical and ultrastructural levels.

**Methods:** Seven healthy adult Japanese volunteers (aged 32-46 years, mean 37.6, five men and two women of Fitzpatrick skin type III) were recruited for this study. A fractional CO₂ laser device, SmartXide DOT (DEKA, Florence, Italy), was used with irradiation parameters set as follows: output power 10 W, pulse width 600 μs, dot spacing 800 μm, and stack 2 (irradiation output power 0.91 J/cm²). A clinical examination and punch biopsy of each subject was performed before and just after the irradiation, and also at week 3 after three irradiation sessions. The biopsy specimens were stained with toluidine blue and were examined ultrastructurally.

**Results:** Clinical improvement of the atrophic acne scars was observed at week 3 after the third irradiation session in all cases compared with the condition before treatment. Histologically, outgrowths of many degenerated elastic fibers were observed as irregular rod-shaped masses in the superficial dermis prior to the treatment in the region of the acne scars. At week 3 after the third irradiation, the degenerated elastic fibers were no longer observed, and the elastic fibers were elaunin-like.

**Conclusion:** The fractional CO₂ laser is considered to be very effective for treating atrophic acne scars.
A study of fractional CO₂ laser resurfacing: the best fluences through a clinical, histological, and ultrastructural evaluation.


**Background:** Fractional resurfacing is a laser treatment modality to create numerous microscopic thermal injury zones of controlled width, depth, and density that are surrounded by a reservoir of spared epidermal and dermal tissue, allowing rapid repair of laser-induced thermal injury.

**Objective:** To evaluate the safety and efficacy of a fractional CO₂ laser system in the treatment of photo-damaged skin with clinical, histological, and ultrastructural evaluation, with special attention to one of the parameters of this laser system: the fluences.

**Materials and Methods:** Twelve patients with Fitzpatrick skin types II to III with photo-damage skin underwent fractional laser treatment with one single-pass superficial on the face and forearm. Clinical outcome and histological and ultrastructural changes were assessed.

**Results:** Light microscopy of biopsies gave important information about skin changes at three different times after fractional treatment, especially revealing some differences between the fluences used in the three groups of patients.

**Conclusion:** Fractional resurfacing offers significant surgical advantages allowing to achieve excellent esthetic results in balance with the biological structure. Besides, our study shows already that with 2.07 and 2.77 J/cm², instead of 4.15 J/cm², it is possible to reach a biological response without scar formation.

Fractionated Carbon Dioxide Laser Treatment of Photoaging: Prospective Study in 45 Patients and Review of the Literature


**Background:** Ablative fractional photothermolysis (AFP) has been reported to be effective for photoaging.

**Objective:** To perform a clinical trial in 45 patients with moderate to severe skin photoaging to quantify improvement with AFP.

**Materials and Methods:** A prospective, single-blind study in 45 patients who presented for desired treatment of photoaging. Patients received a series of two to three treatments with AFP.

**Results:** Thirty-nine women (86.7%) and six men (13.3%) were enrolled. Patients received two or three treatment sessions (mean 2.4). There were no incidence of adverse events of scarring, prolonged erythema (lasting more than 7 days), postinflammatory hyper- or hypopigmentation, or infection in the 108 treatment sessions given during this study. Mean improvement was 48.5% (95% confidence interval (CI) = 44.6–52.4%) for skin texture, 50.3% (95% CI = 46.1–54.5%) for skin laxity, 53.9% (95% CI = 49.5–58.5%) for dyschromia, and 52.4% (95% CI = 47.9–56.9%) for overall cosmetic outcome (all po.05).

**Conclusions:** Significant improvement in photoaging of the face can be achieved using an AFP device with skin types I to III after a series of two to three treatments.
Multi-center clinical study and review of fractional ablative CO₂ laser resurfacing for the treatment of rhytides, photoaging, scars and striae.


Laser skin resurfacing has shifted over the past two decades from standard ablative resurfacing to non-ablative resurfacing and most recently, to fractional laser resurfacing. In this most recent category, fractional non-ablative lasers were first introduced followed by fractional ablative lasers, which offer an improved balance between safety and efficacy. In the current article, a review of fractional ablative resurfacing is presented alongside the results from a multi-center clinical study employing the fractional carbon dioxide (CO₂) laser (SmartXide DOT, DEKA) for the treatment of rhytides, photoaging, scars and striae distensae.

- Técnica de Croll: cirurgia de reconstrução com laser localizado em cicatrices de acne.


Acne scars are a common however difficult to treat condition. There are a number of laser-based techniques for their correction; fractional CO₂ lasers are currently the most frequently used. In order to obtain good results, interventions can, however, become considerably aggressive. Therefore, we propose a new fractional CO₂ laser technique, performed only on acne scars. The objective is to optimize results with minimal side-effects. We have named it the CROLL Technique – in an analogy to the CROSS technique.


Tierney EP, Hanke CW. - Journal of Drugs and Dermatology (JDD). Nov 2010

Background: The carbon dioxide laser (CO₂) has been proven to be an effective device for the treatment of photoaging. However, it is associated with adverse side effects including prolonged erythema, edema, burning, milia, acne, crusting and hypo/hyperpigmentation. Delayed on set hypopigmentation after CO₂ laser resurfacing can markedly detract from clinical outcomes. To overcome the disadvantages of traditional ablative and non-ablative resurfacing, fractional photothermolysis (FP) has been introduced. FP has been demonstrated in early case reports and case series to produce significant improvement in hypopigmentation of acne and surgical scars.

Case Report: A 53-year-old Caucasian female with Fitzpatrick type I skin presented with a nine-month history of delayed onset hypopigmentation following ablative CO₂ laser resurfacing. After a series of three treatments at eight-week intervals with an ablative fractionated CO₂ laser device, the hypopigmentation and line of pigmented demarcation between the face and neck improved by 75 percent.

Conclusion: Ablative fractional resurfacing is a safe and potentially effective modality for the treatment of CO₂ laser induced hypopigmentation on the face.


The physical principle of the efficacy and the reduced risk of CO₂ fractional lasers is the generation of controlled columns of thermal damage, the so-called Microthermal zones (MTZ) or DOT. These require certain specific characteristics of emission so to ensure the maximum efficacy and minimum unwanted skin damage. The stimulation effect of collagen and skin rejuvenation are due to the depth of the thermal damage in dermal layers, which triggers the generation of new collagen and repair tissue. The objective of this study has been to evaluate the effect of a CO₂ fractional laser (SmartXide, Deka) on the epidermal and dermal layers and the use of confocal microscopy together with the fractional mode (DOT on) system, to determine in vivo the maximum depth of the laser thermal effect. The fractional mode, with also an interlaced scan mode, uses the “Stack” parameter to multiply the depth of the pulses in tissues up to the deepest layers while the parameters of potency remain unchanged, and to determine the spot diameter in skin tissue from the surface to the depth. Our study has demonstrated that the SmartXide CO₂ fractional laser, with the use of conservative settings, emits pulses with a regular shape in the whole columns. By changing the emission to penetrate into depth (DOT On mode, Stack On), it is possible to highlight the thermal damage to a depth up to more than 400 μm.

A prospective study of the improvement in periorbital wrinkles and eyebrow elevation with a novel fractional CO₂ laser. The fractional eyelift.

Ancona D, Katz BE. - Journal of Drugs and Dermatology (JDD). Jan 2010

Background and Objective: The purpose of this study was to assess the efficacy and safety of a new fractional CO₂ laser system for improving periorbital rhytids, tightening skin and elevating the eyebrow.

Materials and Methods: One hundred subjects with periocular wrinkles, tissue laxity, photoaged skin and moderate dermatochalasis of the face were prospectively treated one to four times in the periorbital area with a fractional CO₂ laser device equipped with a scanning handpiece. Improvements in eyelid wrinkles, crow's feet and skin laxity were evaluated photographically by two blinded, independent observers. Eyebrow elevation was measured by the investigators. Subjects also scored satisfaction and tolerability.

Results: Approximately half of subjects achieved or maintained 26-50% improvement at 12 months. Nearly 40% of subjects maintained 1-2 mm elevation of the brow at six and 12 months after treatment. Subject satisfaction was high and the procedure was well tolerated. Mild-to-moderate erythema and edema persisted for up to three to four days.

Conclusion: Treatment with a fractional CO₂ laser device improves periorbital rhytids, tightens skin and elevates the eyebrow with minimal adverse effects.
Fractional CO₂ laser: A novel therapeutic device upon photobiomodulation of tissue remodeling and cytokine pathway of tissue repair.


Minimally ablative fractional laser devices have gained acceptance as a preferred method for skin resurfacing. Notable improvements in facial rhytides, photodamage, acne scarring, and skin laxity have been reported. The aim of the present work was to compare how different CO₂ laser fluences, by modulating the secretory pathway of cytokines, are able to influence the wound-healing process, and how these fluences are associated with different clinical results. Eighteen patients, all with photodamaged skin, were treated using a fractional CO₂ laser (SmartXide DOT, Deka M.E.L.A., Florence, Italy) with varying laser fluences (2.07, 2.77, and 4.15 J/cm²). An immunocytochemical study was performed at defined end points in order to obtain information about specific cytokines of the microenvironment before and after treatment. The secretory pathway of cytokines changed depending on the re-epithelization and the different laser fluences. Different but significant improvements in wrinkles, skin texture, and hyperpigmentation were definitely obtained when using 2.07, 2.77, and 4.15 J/cm², indicating fractional CO₂ laser as a valuable tool in photorejuvenation with good clinical results, rapid downtime, and an excellent safety profile.
Treatment of Poikiloderma of Civatte with ablative fractional laser resurfacing: prospective study and review of the literature.

Tierney E.P, Hanke CW. - *Journal Of Drugs and Dermatology (JDD).* Jun 2009

**Background:** Previous laser treatments for Poikiloderma of Civatte (PC) (i.e., Pulsed Dye, Intense Pulsed Light, KTP and Argon) are limited by side effect profiles and/or efficacy. Given the high degree of safety and efficacy of ablative fractional photothermolysis (AFP) for photoaging, we set out to assess the efficacy of PC with AFP.

**Design:** A prospective pilot study for PC in 10 subjects with a series of 1-3 treatment sessions. Treatment sessions were administered at 6-8 week intervals with blinded physician photographic analysis of improvement at 2 months post-treatment. Evaluation was performed of five clinical indicators, erythema/telangiectasia, dyschromia, skin texture, skin laxity and cosmetic outcome.

**Results:** The number of treatments required for improvement of PC ranged from 1 to 3, with an average of 1.4. For erythema/telangiectasia, the mean score improved 65.0% (95% CI: 60.7%, 69.3%) dyschromia, 66.7% (95% CI: 61.8%, 71.6%), skin texture, 51.7% (95% CI: 48.3%, 55.1%) and skin laxity, 52.5% (95% CI: 49.6%, 55.4%). For cosmetic outcome, the mean score improved 66.7% (95% CI: 62.6%, 70.8%) at 2 months post-treatment.

**Conclusion:** In this prospective study, AFP was both safe and effective for the treatment of the vascular, pigmentary and textural components of PC. The degree of improvement observed in wrinkling, creping and laxity after AFP has not been reported with prior laser treatments for PC.

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Preliminary observations on fractional ablative resurfacing devices: clinical impressions.


Fractional resurfacing has become an increasingly popular treatment for photodamage. Non-ablative and ablative fractional resurfacing modalities both have a variety of different devices that may be utilized for treatments. Each modality has its own benefits and drawbacks. In this article, the authors offer preliminary observations from hands-on experience with several different ablative fractional lasers presently available.
Ablative skin resurfacing with a novel microablative CO₂ laser.


Carbon dioxide (CO₂) laser skin resurfacing has been a mainstay of facial rejuvenation since its introduction in the mid 1990s. Recently, a new generation of fractional or microablative CO₂ lasers has been introduced to the marketplace. According to the concept of fractional photothermolysis, these lasers ablate only a fraction of the epidermal and dermal architecture in the treatment area. An array of microscopic thermal wounds is created that ablates the epidermis and dermis within very tiny zones; adjacent to these areas, the epidermis and dermis are spared. This microablative process of laser skin resurfacing has proven safe and effective not only for facial rejuvenation, but elsewhere on the body as well. It is capable of improving wrinkles, acne scars, and other types of atrophic scars and benign pigmented lesions associated with elastotic, sun-damaged skin. Because of the areas of spared epidermis and dermis inherent in a procedure that employs fractional photothermolysis, healing is more rapid compared to fully ablative CO₂ laser skin resurfacing and downtime is proportionately reduced. A series of 32 consecutive patients underwent a single laser resurfacing procedure with the a new microablative CO₂ laser. All patients were followed for a minimum of 6 months and were asked to complete patient satisfaction questionnaires; a 6 month postoperative photographic evaluation by an independent physician, not involved in the treatment, was also performed. Both sets of data were graded and reported on a quartile scale. Results demonstrated greater than 50% improvement in almost all patients with those undergoing treatment for wrinkles, epidermal pigment or solar elastosis deriving the greatest change for the better (>75%).
Fractional laser Skin Resurfacing with SmartXide DOT: Initial Results


The natural ageing process together with exposure to the sun and pollution leads to a gradual deterioration of the skin’s structure and function. Resurfacing with ultra-pulsed CO₂ has always been considered the first choice of treatment. However, over recent years, the market has therefore been orientated towards less invasive and less problematic systems and methods. In this paper is presented a new system called SmartXide (Deka, Florence, Italy) that works with a scanner in DOT mode. It has been used in two cases 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. In the second case a 32 year-old man was treated for a keloid on his chest. The result in both cases were satisfactory. SmartXide effectively combine all the needs of both medical practitioners and patients, and namely, the Fractional Laser Skin Resurfacing with CO₂ laser.

CO₂ laser therapy in a case of steatocystoma multiplex with prominent nodules on the face and neck.


Background: Steatocystoma multiplex is an uncommon disorder which usually begins in adolescence or early adult life. The condition can be hereditary, as an autosomal dominant trait, or nonhereditary, as in this case.

Methods: A 40-year-old woman presented with a history of asymptomatic nodules that began around puberty on the face. There was no family history of similar lesions. Clinical examination revealed multiple nodules distributed on the face and neck. The histopathologic examination of a biopsy specimen showed the typical features of steatocystoma multiplex. CO₂ laser therapy without anesthesia was employed, and the contents were evacuated by squeezing the cysts with a pair of forceps.

Results: Very good results were obtained with rapid healing, minimal invasiveness, and without anesthesia. There was no evidence of scar formation and no signs of recurrence at 2-year follow-up.

Conclusions: Different treatments have been reported for steatocystoma multiplex. We consider CO₂ laser therapy to be an ideal technique for the treatment of steatocystoma multiplex, especially when the lesions are localized in aesthetically important areas.