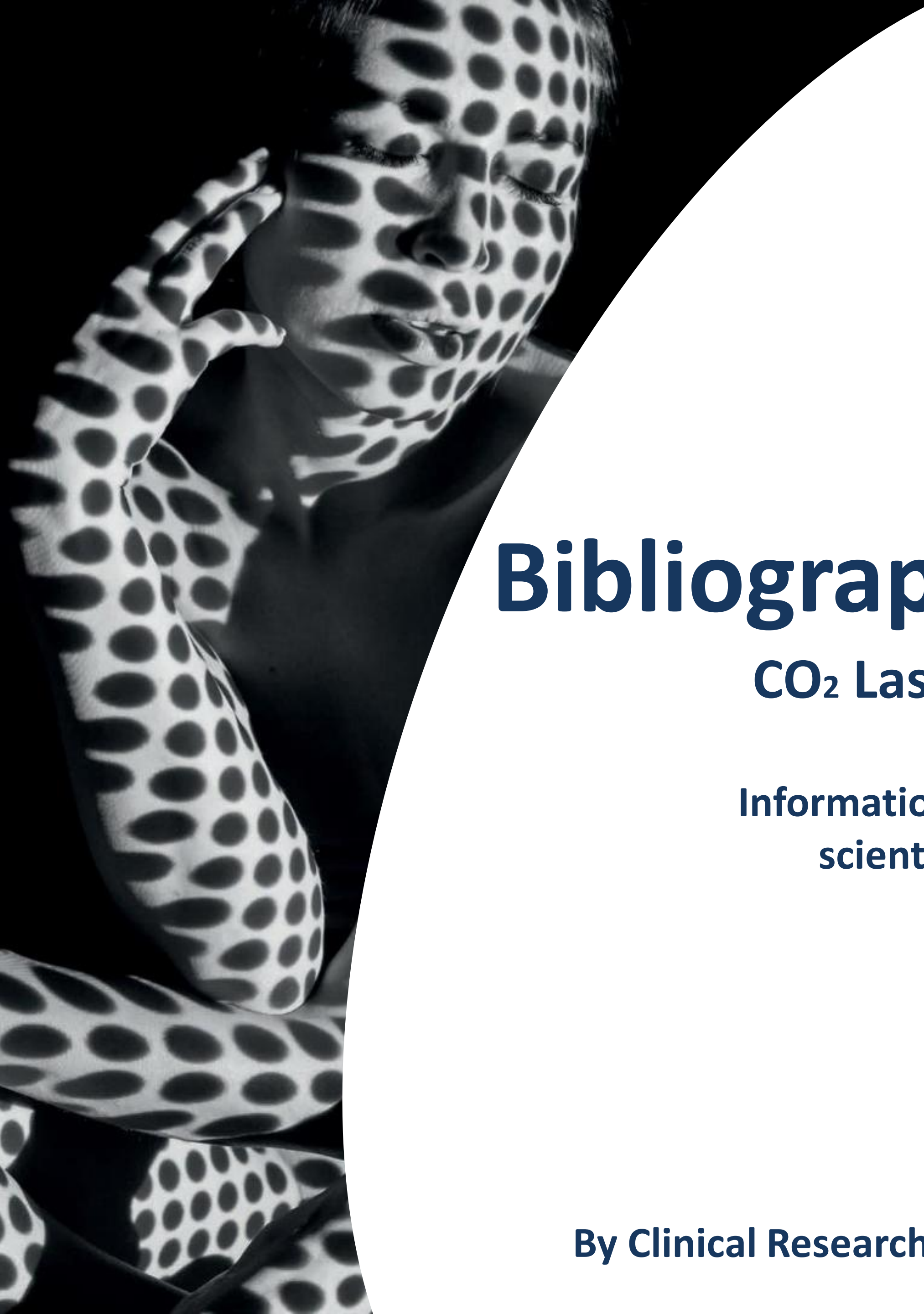

November 2023

Bibliographic Atlas Rev. 1.0

CO_2 Laser in Dermatological Applications

Information gathered from scientific research

By Clinical Research & Practice (CRP) Department

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  - Nevi
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  - Xanthelasma
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Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Apocrine/eccrine hidrocystomas

OPEN ACCESS Freely available online

Journal of Clinical & Experimental Dermatology Research

Case Report

Multiple Apocrine Hidrocystomas of the Eyelids: A Case Successfully Treated Using Ultrapulsed Carbon Dioxide Laser and Literature Review

Antonio Russo[1*], Cannarozzo G[2], Sannino M[2], De Luca G[3]

- In mild sedation and with topical anesthesia with Oxybrupocaine Hydrochloride (Novesin) 4 mg/ml eyedrops, physicians placed **laser resistant eyeball shields**.

- **Anesthesia** with local injection of lidocaine 2% on the eyelids and the zygomatic areas to treat.

- **CO_2 laser ablation of each cyst** in High Pulse modality using 0.4-0.8 W ah 50 Hz down to its back wall in the papillary dermis.

- During the procedure , they took care to clear with **gauze moistened with sodium chloride solution** the treated areas from the necrotic tissue in order to reduce the risk of carbonization e consequently of rectracting scars.

- At the end of the operation **a cold pack was left on for 30 minutes** and then we applied an **antibiotic tobramycin cream** with a q-tip.

OPEN ACCESS Freely available online

Journal of Clinical & Experimental Dermatology Research

ISSN: 2155-9554

Case Report

Multiple Apocrine Hidrocystomas of the Eyelids: A Case Successfully Treated Using Ultrapulsed Carbon Dioxide Laser and Literature Review

Antonio Russo[1*], Cannarozzo G[2], Sannino M[2], De Luca G[3]

Lasers in Medical Science
https://doi.org/10.1007/s10103-021-03424-9

BRIEF REPORT

CO_2 laser in the management of eccrine hidrocystomas: a retrospective study

G. Fazia[1] · G. Cannarozzo[2] · Luigi Bennardo[1] · S. P. Nisticò[1]

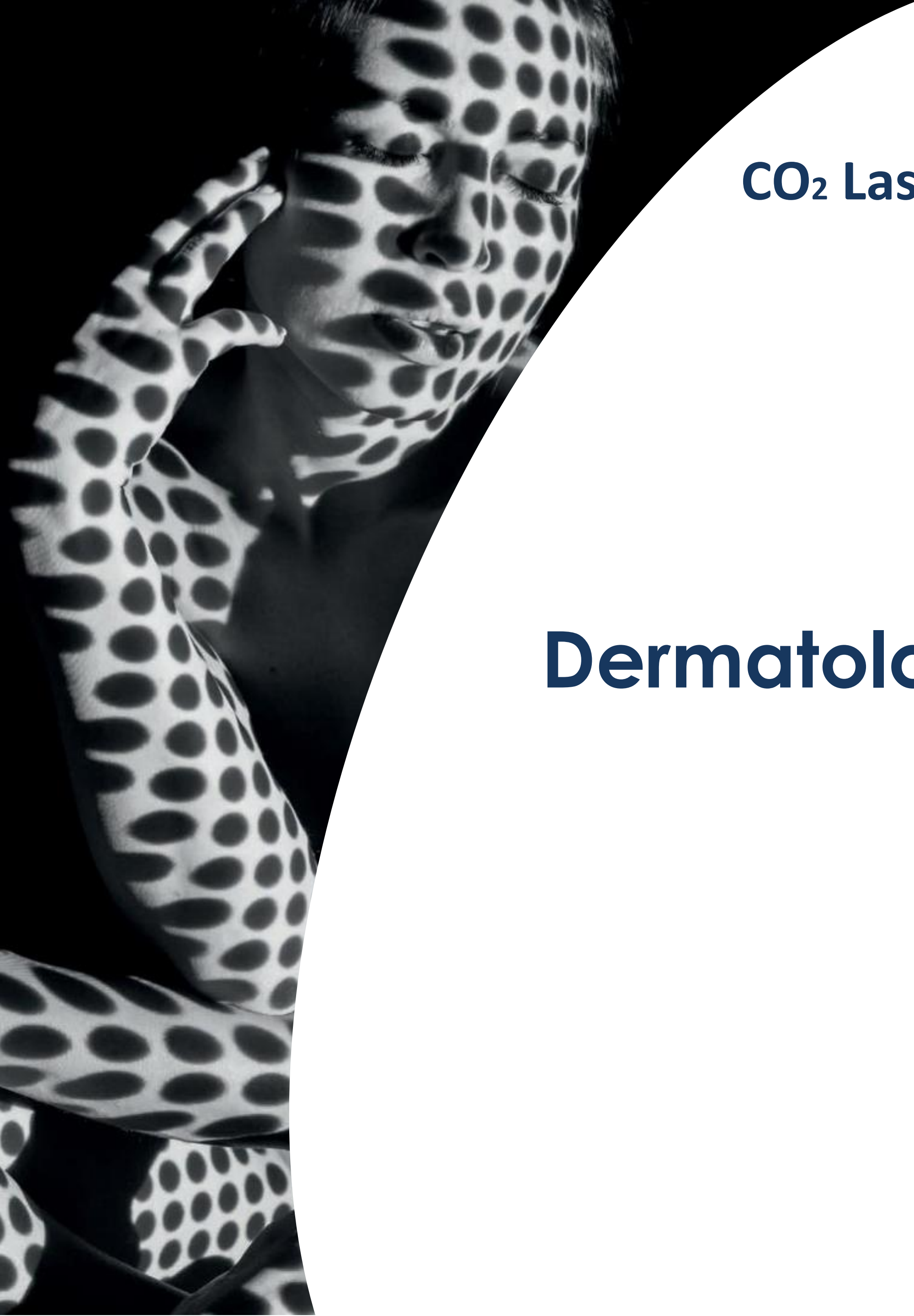
Fig. 1 Patient 16 before treatment (left) and 6 months after laser surgery (right)

Fig. 2 Patient 16 right periocular region before treatment (left), right after the procedure (central), and 6 months after laser surgery (right)

The treatment protocol consist of a session of **CO2 laser** with a power of 0.5-2W and a frequency of 10 Hz, SP Pulse in order to vaporized the lesions.
The power was then lowered down to 0.3 W to refine the more sensitive areas in the same surgical session.

Bibliographic Atlas

CO_2 Laser in Dermatological Applications



Dermatological Surgery

Keloids

Plastic and Reconstructive Surgery®
Journal of the American Society of Plastic Surgeons

LETTERS

A New Carbon Dioxide Laser Combined with Cyanoacrylate Glue to Treat Earlobe Keloids

Tenna, Stefania M.D., Ph.D.; Aveta, Achille M.D.; Filoni, Angela M.D.; Persichetti, Paolo M.D., Ph.D.

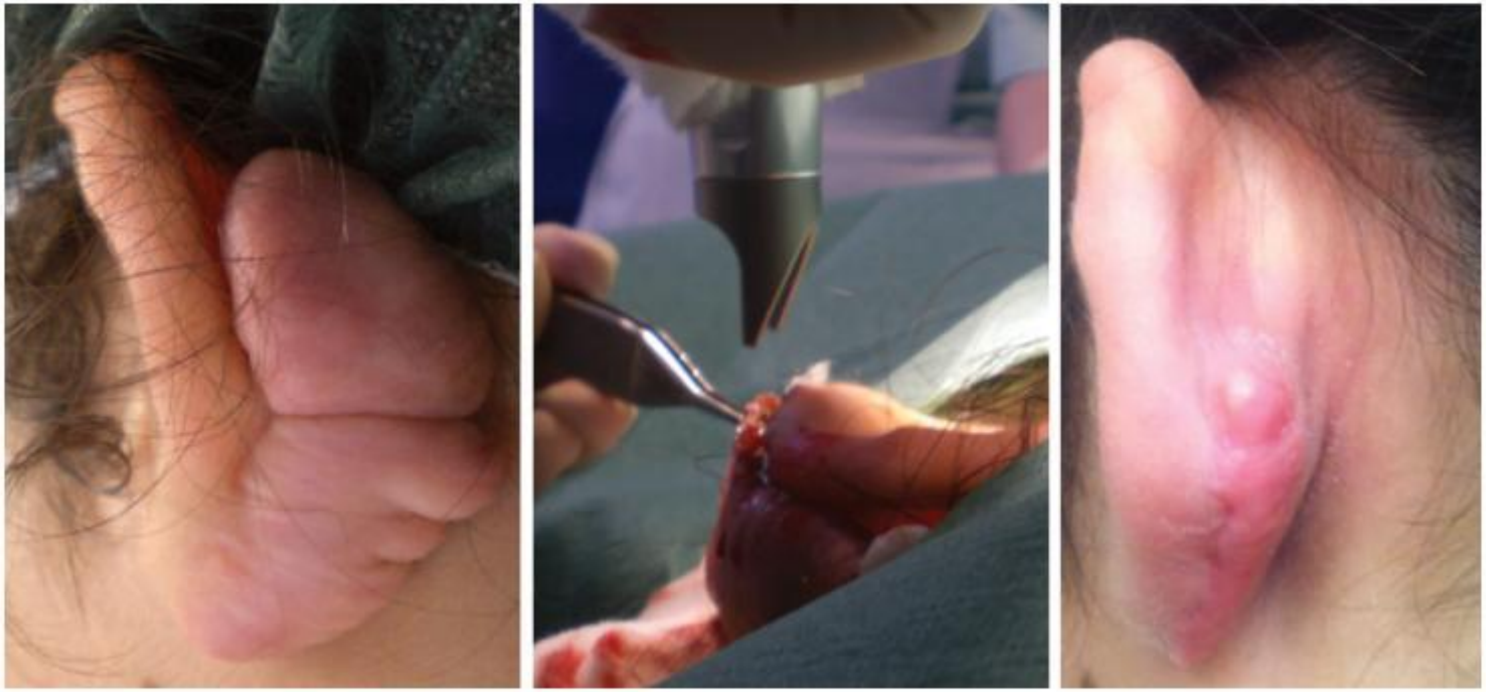


Fig. 2. Keloid on the left posterior auricular area preoperatively (*left*), intraoperatively (*center*), and 10 months postoperatively (*right*).

Plastic and Reconstructive Surgery®
Journal of the American Society of Plastic Surgeons

LETTERS

A New Carbon Dioxide Laser Combined with Cyanoacrylate Glue to Treat Earlobe Keloids

Tenna, Stefania M.D., Ph.D.; Aveta, Achille M.D.; Filoni, Angela M.D.; Persichetti, Paolo M.D., Ph.D.

Fig. 1. Keloid of the ear lobule preoperatively (*left*) and 1 year postoperatively (*right*).

ORIGINAL ARTICLE

Combined laser treatment for ear keloids: Case series

Comparison between two mini-invasive protocols

Domenico Piccolo MD[1] | Giuliana Crisman MD[1] | Bruno Bovani MD[2,3] | Alessandro Gennai MD[4] | Fabrizio Melfa MD[5] | Matteo Tretti Clementoni MD[6] | Claudio Conforti MD[7]

FIGURE 17 Before (left) and after (right) a single protocol session with PDL + CO2 laser + Enerjet, and after 14 months (right)

FIGURE 5 Type V: a 4.7 cm in diameter mixed Keloid of 3 cm in diameter was diagnosed in a 27-year-old man, arose after an ear piercing

These patients were treated with a single **CO_2 laser session** (power 4W, frequency of 80 Hz) followed by a **single pulsed dye laser procedure** (Fluency 11 J/cm2, single pulse, pulse duration 1.5 ms, PDL spot 5-7 mm) and, only for some patients, a further session with a **pneumatic injection without needle of drugs** (Enjerit 2.0).

ORIGINAL ARTICLE

JCD Journal of Cosmetic Dermatology WILEY

Combined laser treatment for ear keloids: Case series

Comparison between two mini-invasive protocols

Domenico Piccolo MD[1] | Giuliana Crisman MD[1] | Bruno Bovani MD[2,3] | Alessandro Gennai MD[4] | Fabrizio Melfa MD[5] | Matteo Tretti Clementoni MD[6] | Claudio Conforti MD[7]

FIGURE 7 Before (left, first picture) and after (second picture) a single protocol session with CO2 laser and PDL. Follow-up: after 3 months (third picture) and 6 months (last picture)

ORIGINAL ARTICLE

JCD Journal of Cosmetic Dermatology WILEY

Combined laser treatment for ear keloids: Case series

Comparison between two mini-invasive protocols

Domenico Piccolo MD[1] | Giuliana Crisman MD[1] | Bruno Bovani MD[2,3] | Alessandro Gennai MD[4] | Fabrizio Melfa MD[5] | Matteo Tretti Clementoni MD[6] | Claudio Conforti MD[7]

FIGURE 12 (A) Before (left) and after a single protocol session with PDL + CO2 laser + Enerjet. Follow up: 6 months (right). Please note, a slight thickening of the scar is visible. (B) Dermoscopic examination before the first session (left) and at the follow-up visit (right): please note the increased number of new vessels. On the basis of this examination, we decided to perform a single session of PDL immediately

FIGURE 16 Before (left) a single protocol session with PDL + CO2 laser + Enerjet and after 12 months (right)

FIGURE 13 Before (up) and after a single protocol session with PDL + CO2 laser + Enerjet in a 24-year-old woman with a 2.8 cm in diameter sessile, multinodulated keloid of the helix. The keloid's weight folded the helix, thus causing a severe psychological distress in the young lady. Follow-up: 8 months (down)

FIGURE 14 Before (left) a single protocol session with PDL + CO2 laser + Enerjet and after 12 months (right)

ORIGINAL ARTICLE

Combined laser treatment for ear keloids: Case series

Comparison between two mini-invasive protocols

Domenico Piccolo MD[1] | Giuliana Crisman MD[1] | Bruno Bovani MD[2,3] | Alessandro Gennai MD[4] | Fabrizio Melfa MD[5] | Matteo Tretti Clementoni MD[6] | Claudio Conforti MD[7]

FIGURE 18 (A) Exceptional lesion occurred as recurrence in a 37-year old man sited on the right helix (5 cm in diameter) after a surgical excision in another center. (B–D) The keloid's weight fold the helix causing a severe psychological distress (three perspective on left pictures) and have been treated with another session of Dye laser followed by CO2 laser followed Enerjet and did not recur again during 10-month follow-up (all right images)

JCD Journal of Cosmetic Dermatology WILEY

ORIGINAL ARTICLE

Combined laser treatment for ear keloids: Case series

Comparison between two mini-invasive protocols

Domenico Piccolo MD[1] | Giuliana Crisman MD[1] | Bruno Bovani MD[2,3] | Alessandro Gennai MD[4] | Fabrizio Melfa MD[5] | Matteo Tretti Clementoni MD[6] | Claudio Conforti MD[7]

FIGURE 1 Type I: a 1.5 cm in-diameter pedunculated Keloid of the helix, in a 35-year-old woman

FIGURE 15 Before (left) a single protocol session with PDL + CO2 laser + Enerjet and after 5 months (right)

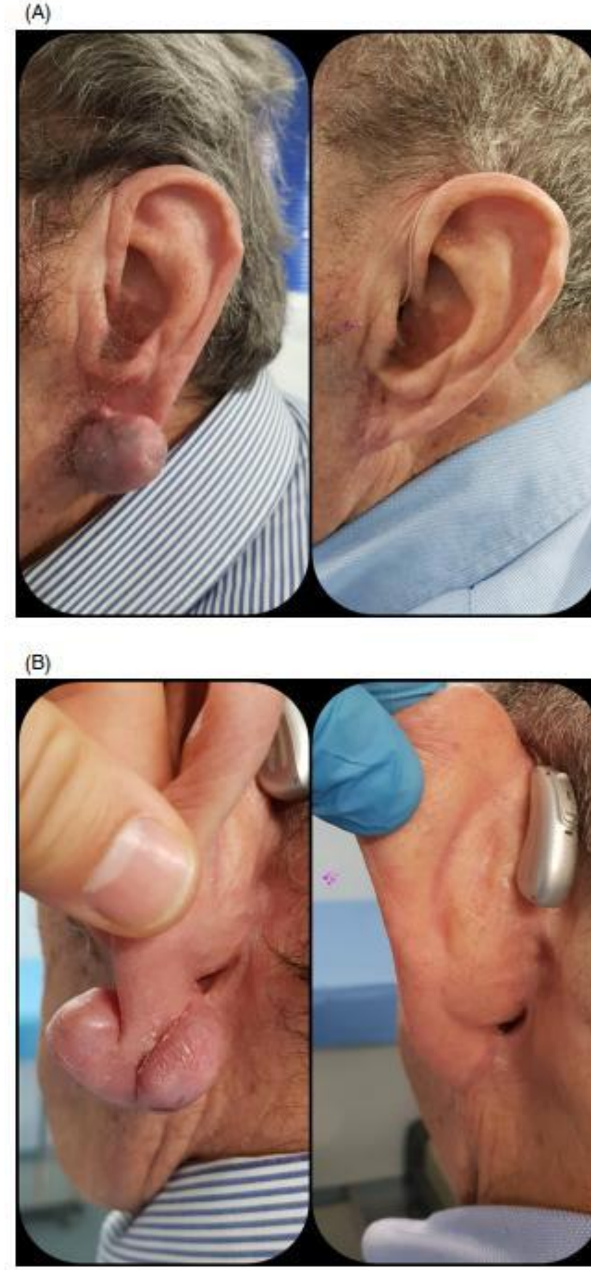


FIGURE 6 (A) Before (left) and after (right) a single protocol session with CO2 laser and PDL. Follow-up: 6 months (right). (B) Same patient, keloid of the posterior earlobe: before (left) and after (right) a single protocol session with CO2 laser and PDL. Follow-up: 6 months (right)

ORIGINAL ARTICLE

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Combined laser treatment for ear keloids: Case series

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Domenico Piccolo MD[1] | Giuliana Crisman MD[1] | Bruno Bovani MD[2,3] | Alessandro Gennai MD[4] | Fabrizio Melfa MD[5] | Matteo Tretti Clementoni MD[6] | Claudio Conforti MD[7]

FIGURE 3 Type III: a sessile with multi nodular pattern Keloid in a 33-year-old man, arose after otoplastic surgery

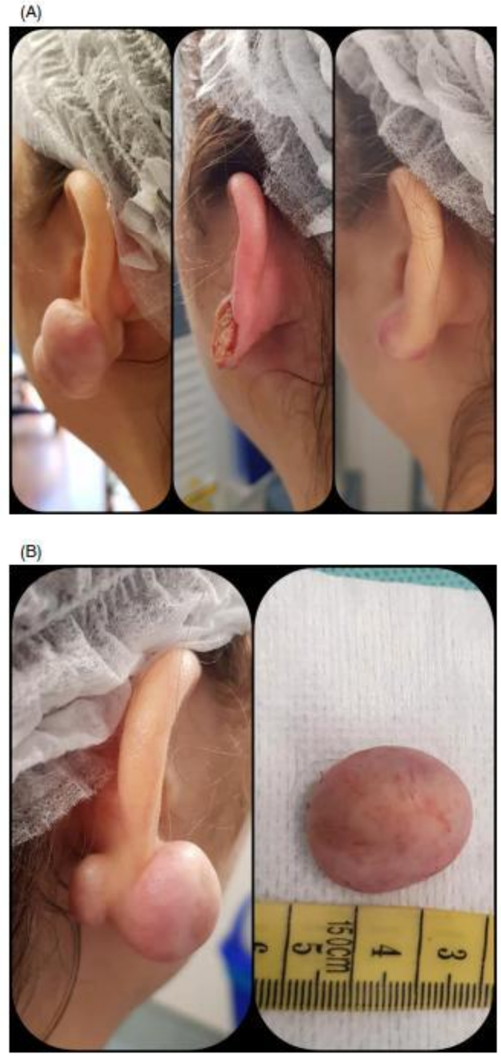

FIGURE 8 (A) Before (left) and after (second picture) a single protocol session with CO2 laser and PDL. Follow-up: 5 years (last picture on the right). (B) Another picture of the 2.5 cm in-diameter keloid before (left) and after (right) CO2 laser excision

FIGURE 9 Before (left, first picture) a single protocol session with CO2 laser and PDL. Follow-up: after 3 months (right)

FIGURE 10 Before (left) and after a single protocol session with CO2 laser and PDL. Follow-up: after 6 months (right)

ORIGINAL ARTICLE

Combined laser treatment for ear keloids: Case series

Comparison between two mini-invasive protocols

Domenico Piccolo MD[1] | Giuliana Crisman MD[1] | Bruno Bovani MD[2,3] |
Alessandro Gennai MD[4] | Fabrizio Melfa MD[5] | Matteo Tretti Clementoni MD[6] |
Claudio Conforti MD[7]

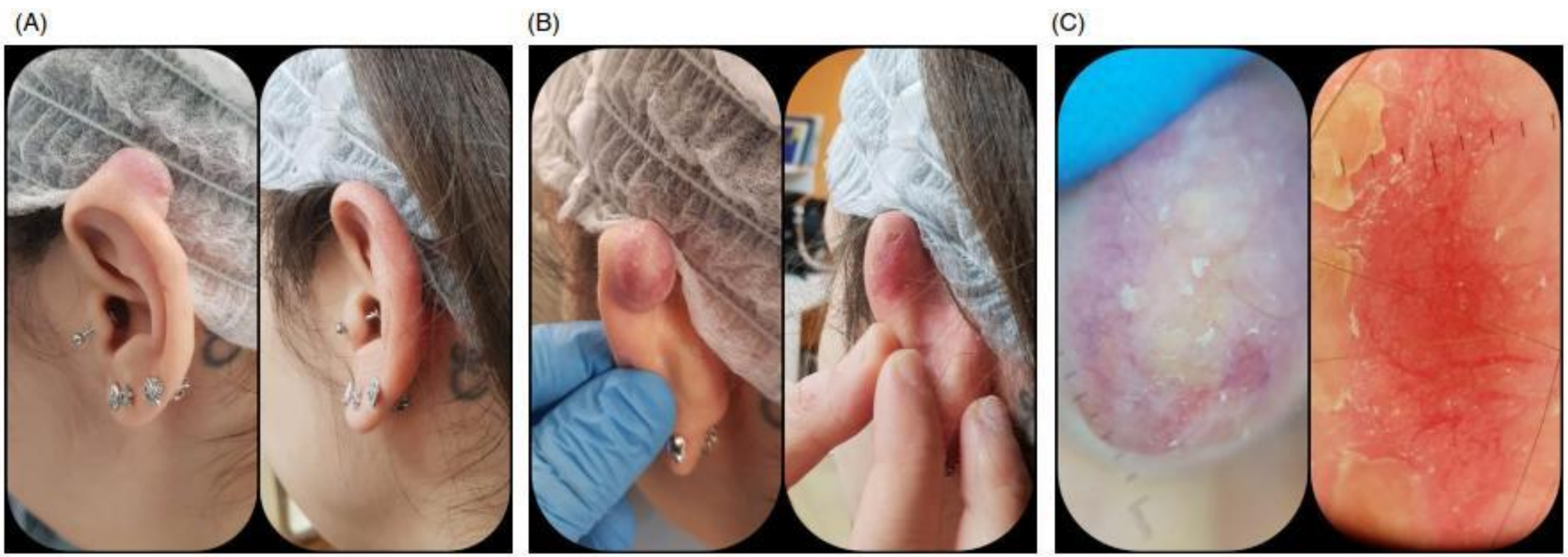

FIGURE 11 (A and B) Before (left) a single protocol session with CO2 laser and PDL and after 6 months (right). (C) Dermoscopic examination before the first session (left) and at the follow-up visit (right): please note the increased number of new vessels. On the basis of this examination, we decided to perform a single session of PDL immediately

Received: 27 September 2023 | Accepted: 9 October 2023
DOI: 10.1111/srt.13502

ORIGINAL ARTICLE

WILEY

Efficacy of a multimodal approach of laser therapy for earlobe keloids management in dark population

Domenico Piccolo[1] | Giuliana Crisman[1] | Claudio Conforti[2,3] | Irene Fusco[4] | Paolo Bonan[5]

Background: Patients with keloids are often younger than 30 years old and have darker skin.
Aim: To evaluate the efficacy and safety of CO_2 laser therapy in the management of earlobe and helix keloids in dark subjects.

Methods: A total of 21 dark patients (five men and 16 women) presented with the earlobe and ear helix keloids, with a mean age of 30.5 (±6.7) years and with phototype between III–VI, were enrolled. In order to improve their earlobe and helix keloids, all patients underwent a single session of CO_2 laser therapy immediately followed by a pulsed Dye laser procedure. A single well-experienced doctor performed all treatment sessions and the response to treatment. Patients were followed-up for 6 months after termination of therapy. Clinical images were examined and collected: all patients were examined clinically and with Dermoscopy.

Results: The majority of the patients treated show complete remission of keloid lesions. Clinical photographs show a visible aesthetic improvement of several types of keloids in dark subjects.

Conclusions: Our data demonstrate that this combined laser therapeutic protocol appears to be effective and well tolerated for the management of earlobe and helix keloids in dark subjects, with no high recurrence rate and avoiding the adverse effects and lengthy recovery time.

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Domenico Piccolo[1] | Giuliana Crisman[1] | Claudio Conforti[2,3] | Irene Fusco[4] | Paolo Bonan[5]

FIGURE 5

Upper panel: digital clinical images before (left) CO2 laser session and after 6 months (right);

Bottom panel: 3D digital clinical images before (left) CO2 laser session and after 6 months (right) acquired with Quantificare system.

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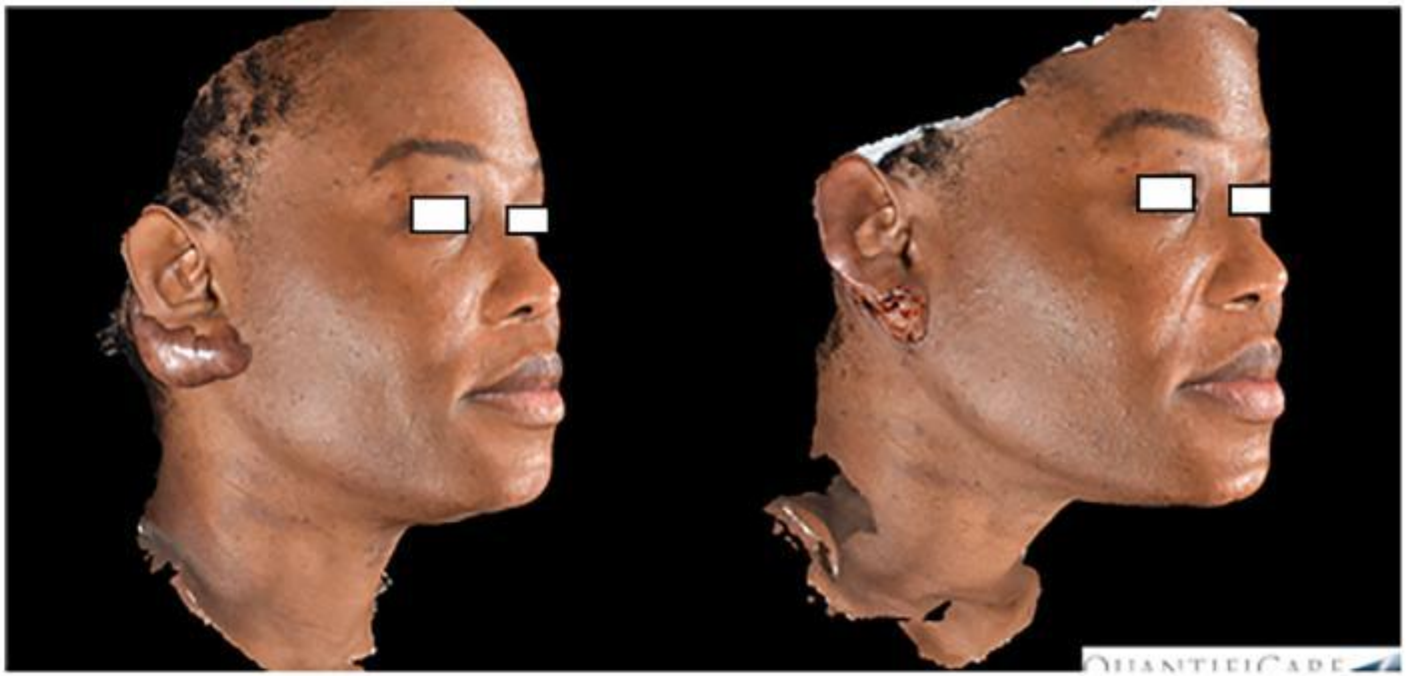

FIGURE 6 3D digital clinical images before (left) session and immediately after CO2 laser (right) acquired with Quantificare system.

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ORIGINAL ARTICLE

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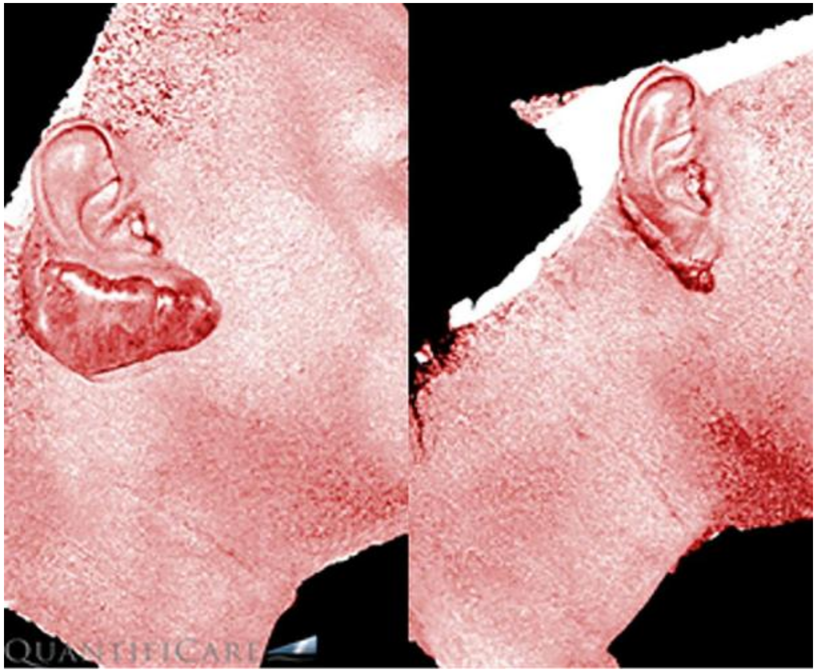
Efficacy of a multimodal approach of laser therapy for earlobe keloids management in dark population

Domenico Piccolo[1] | Giuliana Crisman[1] | Claudio Conforti[2,3] | Irene Fusco[4] | Paolo Bonan[5]



In order to improve their earlobe and helix keloids, a total of 21 patients underwent Glide **CO2 laser** (DEKA, Florence, Italy) surgery immediately followed by a single **pulsed Dye laser** (VasQ, DEKA M.E.L.A., Calenzano, Italy) procedure (fluency: 6.5 J/cm2; single pulse, pulse duration 0.5 ms, PDL spot 12 mm) on each lesion. The setting is developed by using the 7″ Handipiece and fits with the dimension a depth of the lesion.

FIGURE 7 3D digital clinical images before (left) CO2 laser session and after 6 months (right) acquired with Vectra H2 digital vascular filter system.

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Efficacy of a multimodal approach of laser therapy for earlobe keloids management in dark population

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FIGURE 8 Digital clinical images before (left) and immediately after CO2 laser session (right)

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ORIGINAL ARTICLE

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Domenico Piccolo[1] | Giuliana Crisman[1] | Claudio Conforti[2,3] | Irene Fusco[4] | Paolo Bonan[5]

FIGURE 9 3D digital clinical images before (left) CO2 laser session and after 6 months (right) acquired with Quantificare system.

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ORIGINAL ARTICLE

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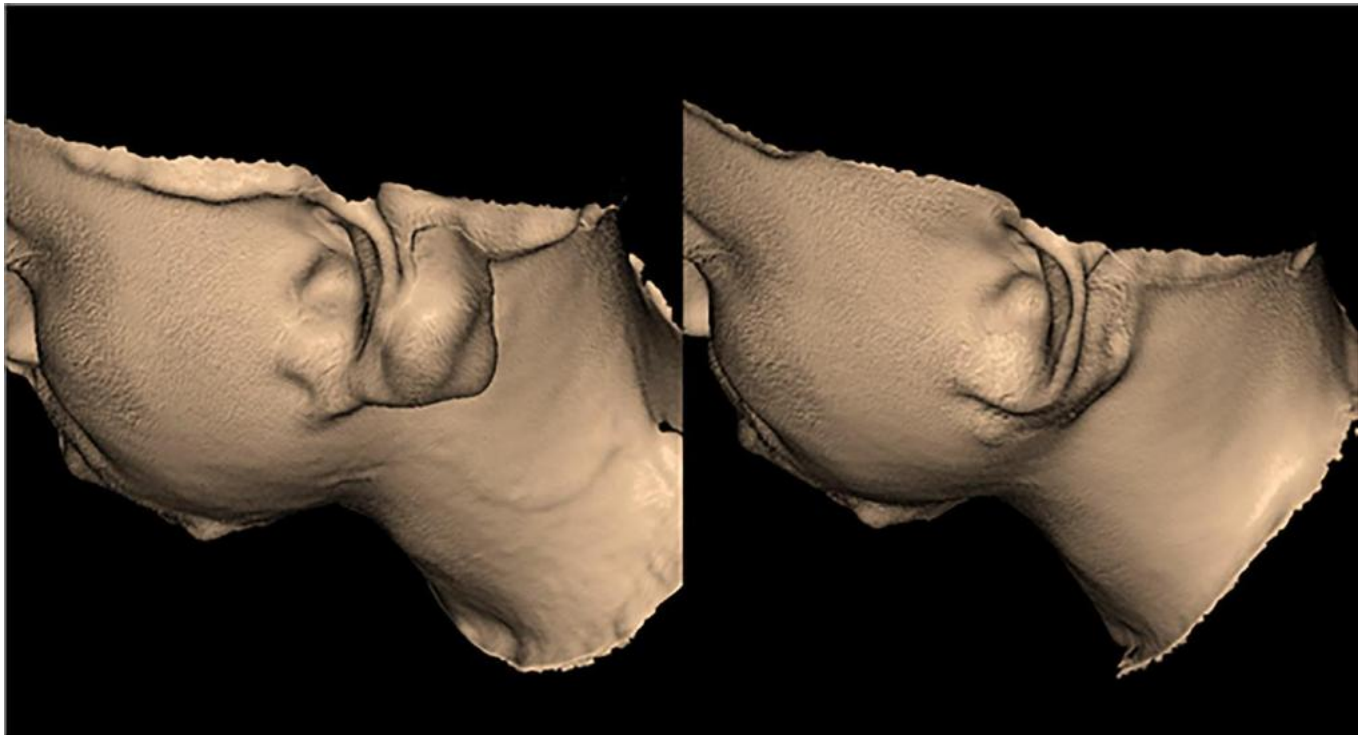
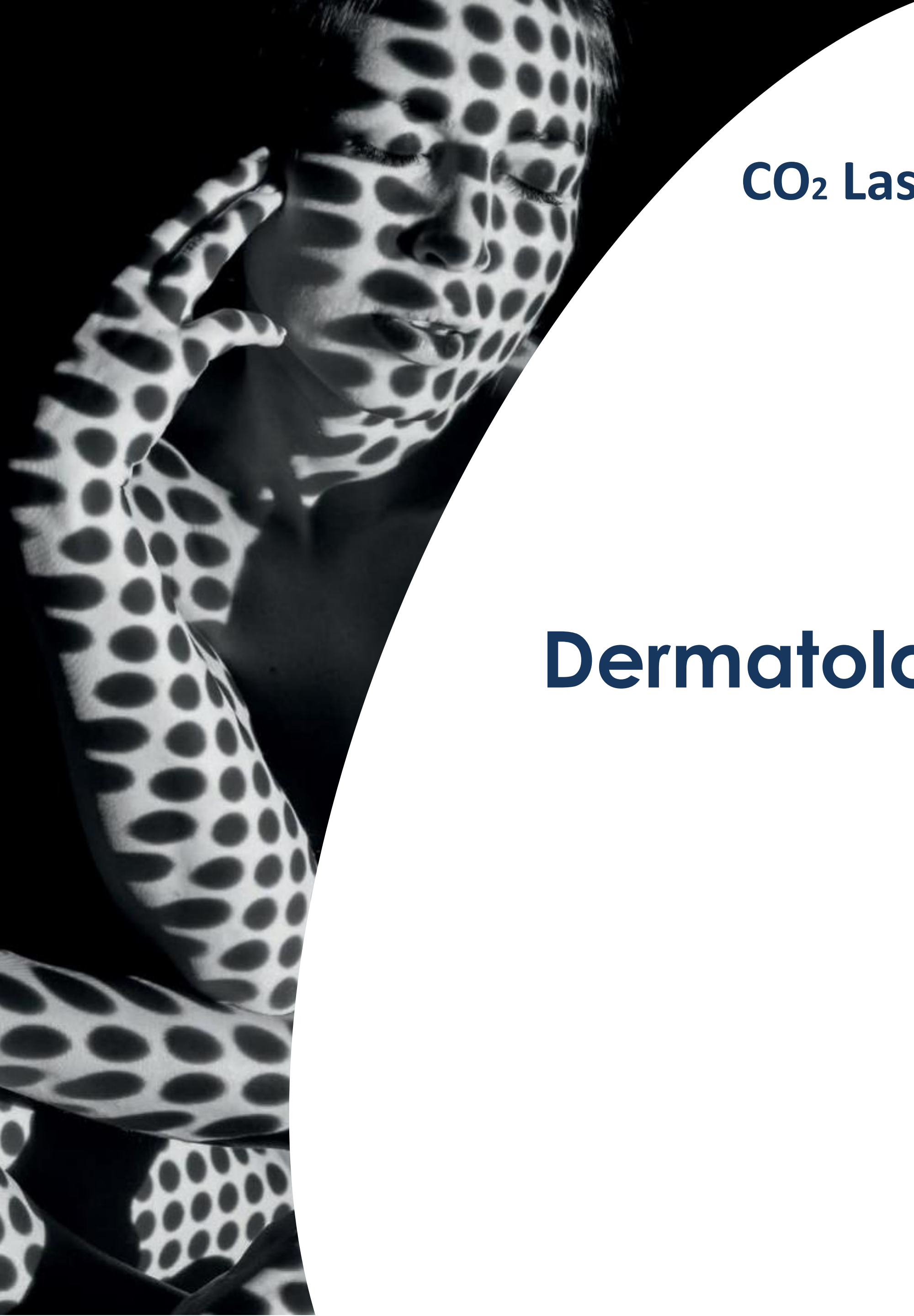


FIGURE 10 3D digital clinical images before (left) CO2 laser session and after 6 months (right) acquired with Quantificare system.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Rhinophyma

Laser surgery in rhinophyma

Andrea BASSI [1*], Piero CAMPOLMI [2], Margherita DINDELLI [1], Nicola BRUSCINO [1], Rossana CONTI [1],
Giovanni CANNAROZZO [1], Nicola PIMPINELLI [2]

CO_2 laser surgery was performed under **local anesthesia** with a 1% lidocaine solution.

A 10600 nm **CO_2 pulsed laser** was used in all patients with the following parameters: starting power of 5-25W, continuous mode (CW). Then change to a pulsed mode (DP) with a starting power of 5W with a frequency of 80-50 Hz until a power of 1 W with a frequency of 10 Hz.

The patients were treated for a maximum of 4 months, receiving a **mean of 4-laser sessions** (range 2-6) with a **3-week interval.**

Figure 1.—The honeycomb aspect of the residual sebaceous glands after the vaporization.

Laser surgery in rhinophyma

Andrea BASSI [1*], Piero CAMPOLMI [2], Margherita DINDELLI [1], Nicola BRUSCINO [1], Rossana CONTI [1], Giovanni CANNAROZZO [1], Nicola PIMPINELLI [2]

Six months after the last laser session all the patients showed **global improvement** of their clinical conditions:

- 19 (79.1%) showed high improvement (>75%);
- 4 (16.7%) moderate improvement(50-75%);
- 1 (4.2%) low improvement(<25%).

The re-epithelization started days immediately after laser treatment and was completed within 3 weeks.

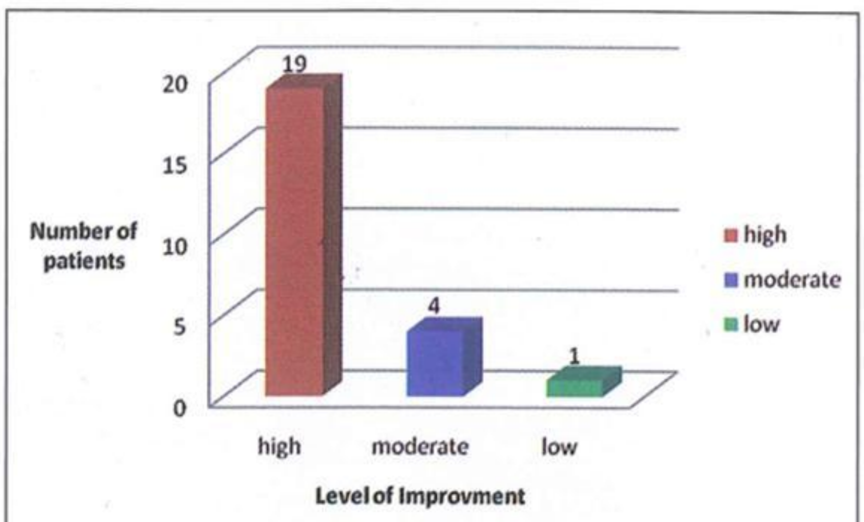
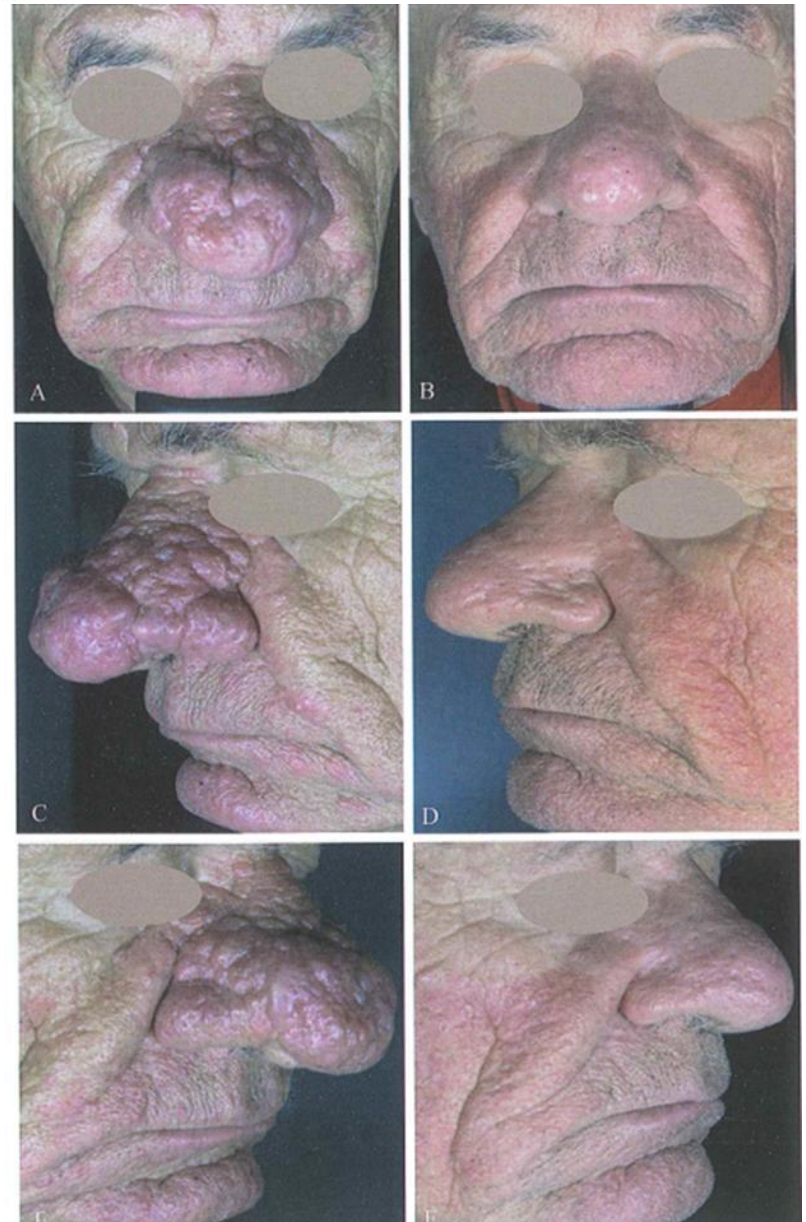


Figure 2.—Dermatologist based assessment: improvement of rhinophyma.



Research Article

Highlights of Thirty-Year Experience of CO_2 Laser Use at the Florence (Italy) Department of Dermatology

Piero Campolmi, Paolo Bonan, Giovanni Cannarozzo, Andrea Bassi, Nicola Bruscino, Meena Arunachalam, Michela Troiano, Torello Lotti, and Silvia Moretti

The CO_2 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 system 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, and 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 see with older methods, using higher power. The percentage of after-treatment keloids and hypertrophic scars oberved 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 diathermocoagulatiopn 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.

Research Article

Highlights of Thirty-Year Experience of CO_2 Laser Use at the Florence (Italy) Department of Dermatology

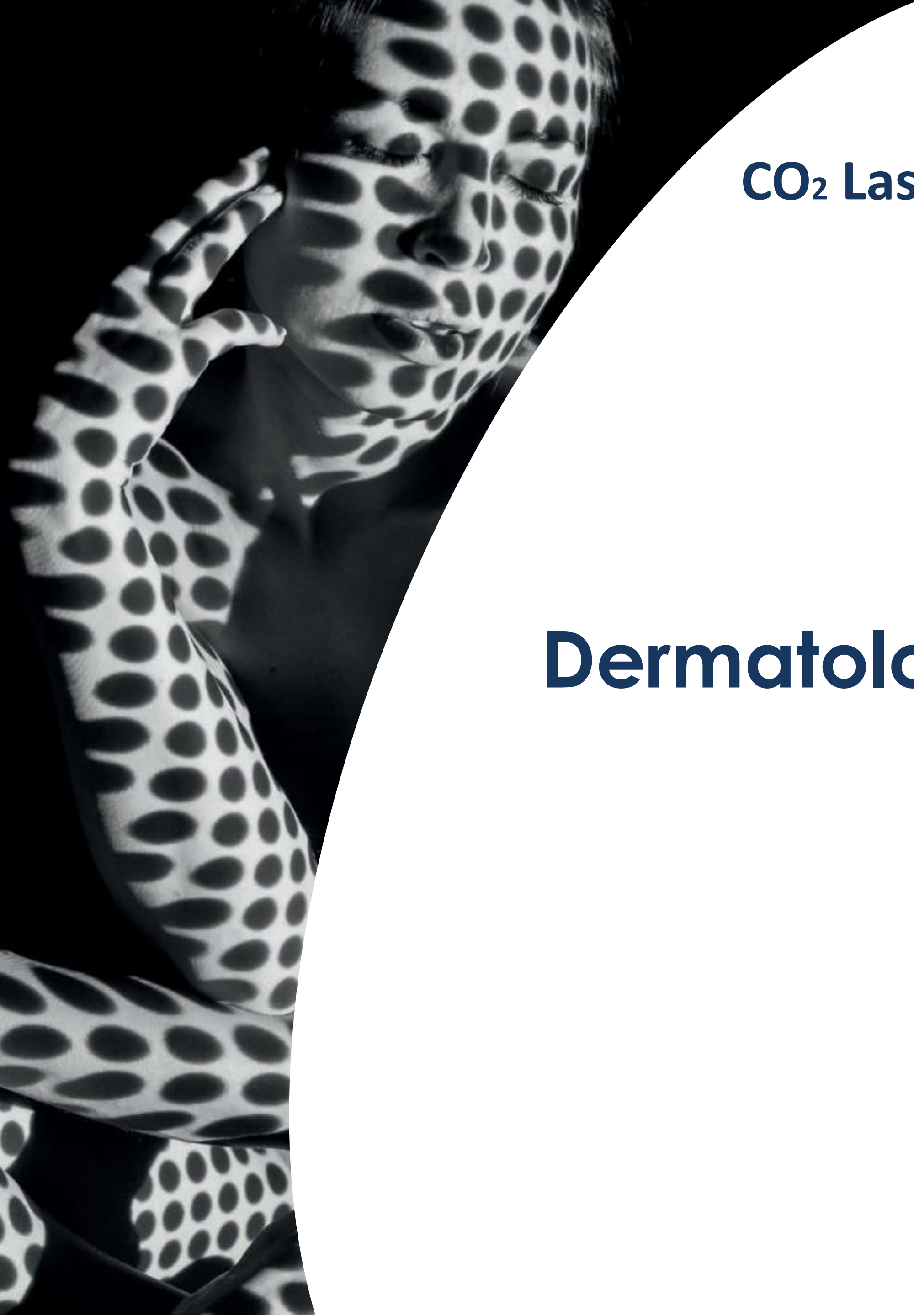
Piero Campolmi, Paolo Bonan, Giovanni Cannarozzo, Andrea Bassi, Nicola Bruscino, Meena Arunachalam, Michela Troiano, Torello Lotti, and Silvia Moretti

(a) (b)

Figure 2: Rhinophyma at first (a) and after (b) five treatments with CO_2 laser.

The choice of the appropriate parameters depend on the size, anatomical localization, and other features of the lesion to be treated.

For **Rhinophyma**: Power 6-10 W
Frequency 50-100Hz
Continuous mode (CW)



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Nevi

JOURNAL OF COSMETIC AND LASER THERAPY
https://doi.org/10.1080/14764172.2021.1990962

A giant epidermal nevus of the face treated with a CO_2 and dye laser combination: a case report and literature review

Mario Sannino[a*], Azzurra Gaia Ambrosio[b*], Giuseppe Lodi[a], Giovanni Cannarozzo[a], Luigi Bennardo[b], and Steven Paul Nisticò[b]

[a]Laser Unit, University of Rome Tor Vergata, Rome, Italy; [b]Department of Health Sciences, University of Magna Graecia, Catanzaro, Italy

Epidermal nevi (EN) are cutaneous hamartomas present at birth, usually occurs in the trunk, the face, or the limbs, appearing as a patch of overgrowing skin. They may be small and localized, but they may interest extensive areas of the body. A 20 years old man came to our attention for an EN interesting all the face.
The treatment protocol consisted of a session of CO2 laser in order to vaporize thicker areas, followed by a session of dye laser on the area to prevent scarring. This treatment was performed under local anesthesia and sedation in three surgical sessions spaced 3 months from each other. Two sessions of dye laser spaced apart 6 months were performed during follow-up to further improve the esthetic outcome. The patient was followed for 2 years with no recurrence. Although surgery is still considered the gold standard in EN management, it is not always feasible. This novel combination technique can obtain optimal cosmetic results with no relapse within the period of follow up. Although further trials on a more significant number of patients are required, the combination of CO2 and dye laser promises to become a valid therapeutic alternative when treating giant EN of the face.

JOURNAL OF COSMETIC AND LASER THERAPY
https://doi.org/10.1080/14764172.2021.1990962

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A giant epidermal nevus of the face treated with a CO_2 and dye laser combination: a case report and literature review

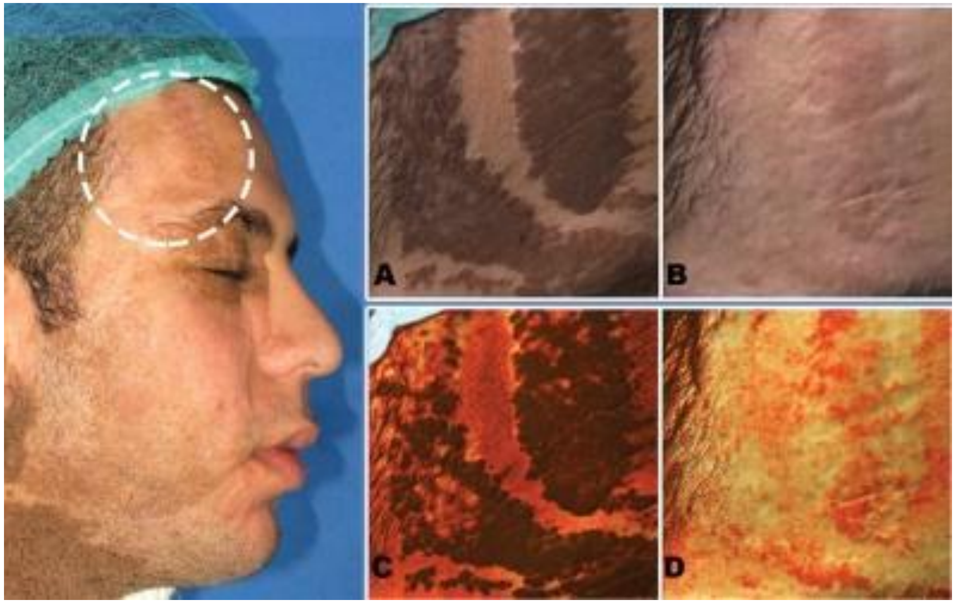
Mario Sannino[a*], Azzurra Gaia Ambrosio[b*], Giuseppe Lodi[a], Giovanni Cannarozzo[a], Luigi Bennardo[b], and Steven Paul Nisticò[b]

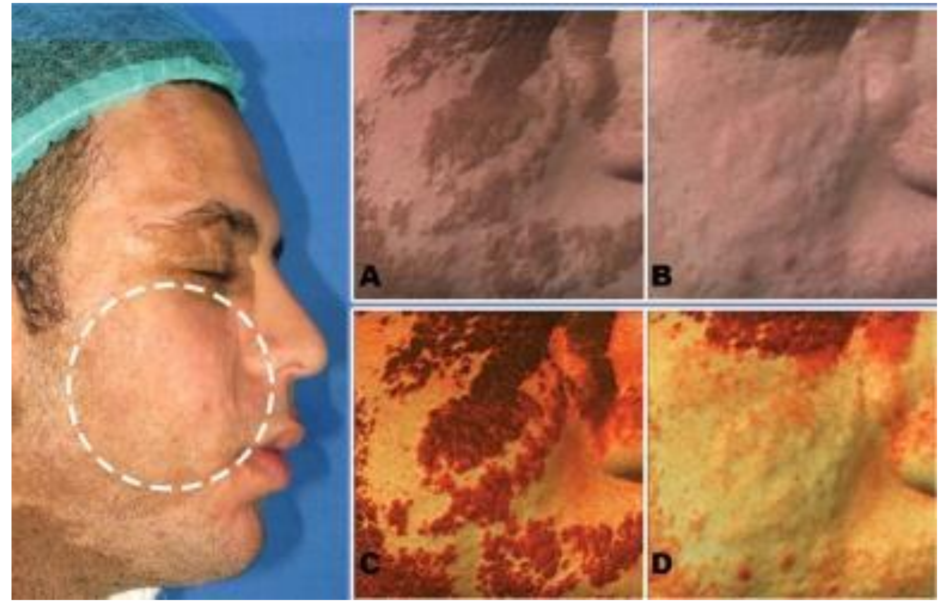
[a]Laser Unit, University of Rome Tor Vergata, Rome, Italy; [b]Department of Health Sciences, University of Magna Graecia, Catanzaro, Italy

"We report for the first time a combination treatment consisting of the use of **dye laser** after **CO2 ablation** with good cosmetic results. The dye laser, which was used after the CO2 laser, acts in two different ways, reducing the vascular component that feeds keloid-type healing and controlling the regenerative process to promote non-hypertrophic healing. This laser is more effective when the inflammatory process is still present, so both lasers must be used in the same session.

[…] The laser explicitly targeting the early phases of wound healing may be the key to scar minimization."

Patient before treatment (a), right after first treatment (b) and after one (c), two (d), three sessions of treatment (e), and then after two years of follow up (F).





Melanin multispectral digital analysis on both right and left side temple and on right side cheek before (a) and after (b) all treatments. Hemoglobin multispectral digital analysis before (c) and two years after (d) combined treatments.

Journal of Cosmetic and Laser Therapy, 2013; 15: 242–245

informa healthcare

CASE REPORTS AND SHORT REPORTS

Inflammatory linear verrucous epidermal nevus: why a combined laser therapy

ROSSANA CONTI, NICOLA BRUSCINO, PIERO CAMPOLMI, PAOLO BONAN, GIOVANNI CANNAROZZO & SILVIA MORETTI

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Inflammatory linear verrucous epidermal nevus (ILVEN) is a benign cutaneous hamartoma, and more precisely an uncommon variant of the verrucous epidermal nevus. In our case report we describe an ILVEN female patient, resistant to previous treatments but responsive to a combined laser therapy, 10600 nm CO2 laser and fractional CO2 laser, with good and longstanding results. A complete resolution of the lesion weas observed at the 9-month follow-up. The application of lasers has been reported in literature over recent years for resolving ILVEN lesions. Based on our clinical experience, 10600 nm CO2 pulsed laser therapy seems to be the best treatment and fractional CO2 laser treatment can be regarded as a very promising technique to combine with CO2 laser for reducing pigment modifications and endowing a more youthful appearance to the treated areas.

Journal of Cosmetic and Laser Therapy, 2013; 15: 242–245

informa healthcare

CASE REPORTS AND SHORT REPORTS

Inflammatory linear verrucous epidermal nevus: why a combined laser therapy

Figure 1. A-B-C: ILVEN lesion located on the trunk, which linearly occupied the skin from under the mammal up to the lumbar region, typically following the lines of Blaschko. (A) An initial explorative laser test is carried out on a small area of the lesion on the right.

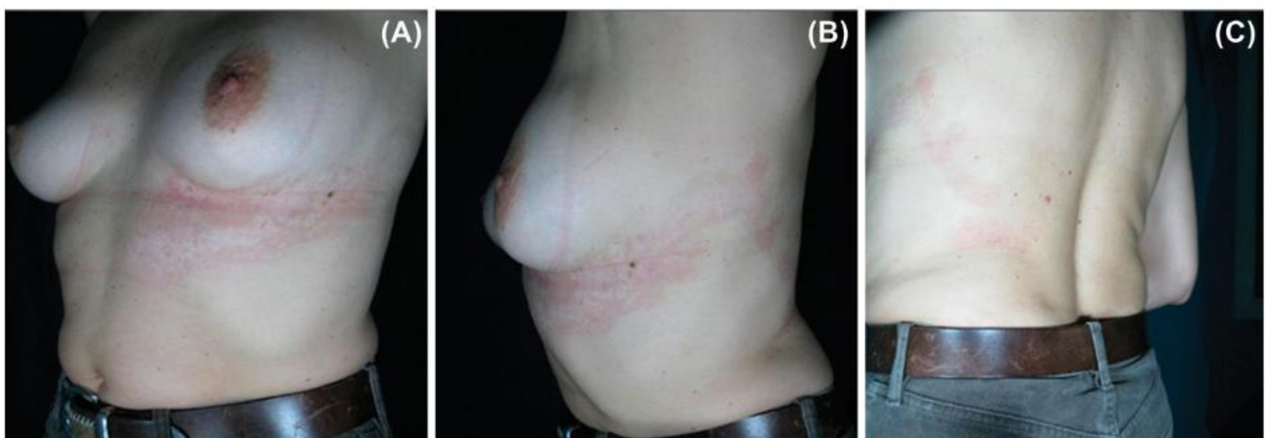

Figure 3. A-B-C: At 9-month follow-up: disappearance of ILVEN lesion, with no recurrences, reduced dischromyas, and improved skin texture.

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CASE REPORTS AND SHORT REPORTS

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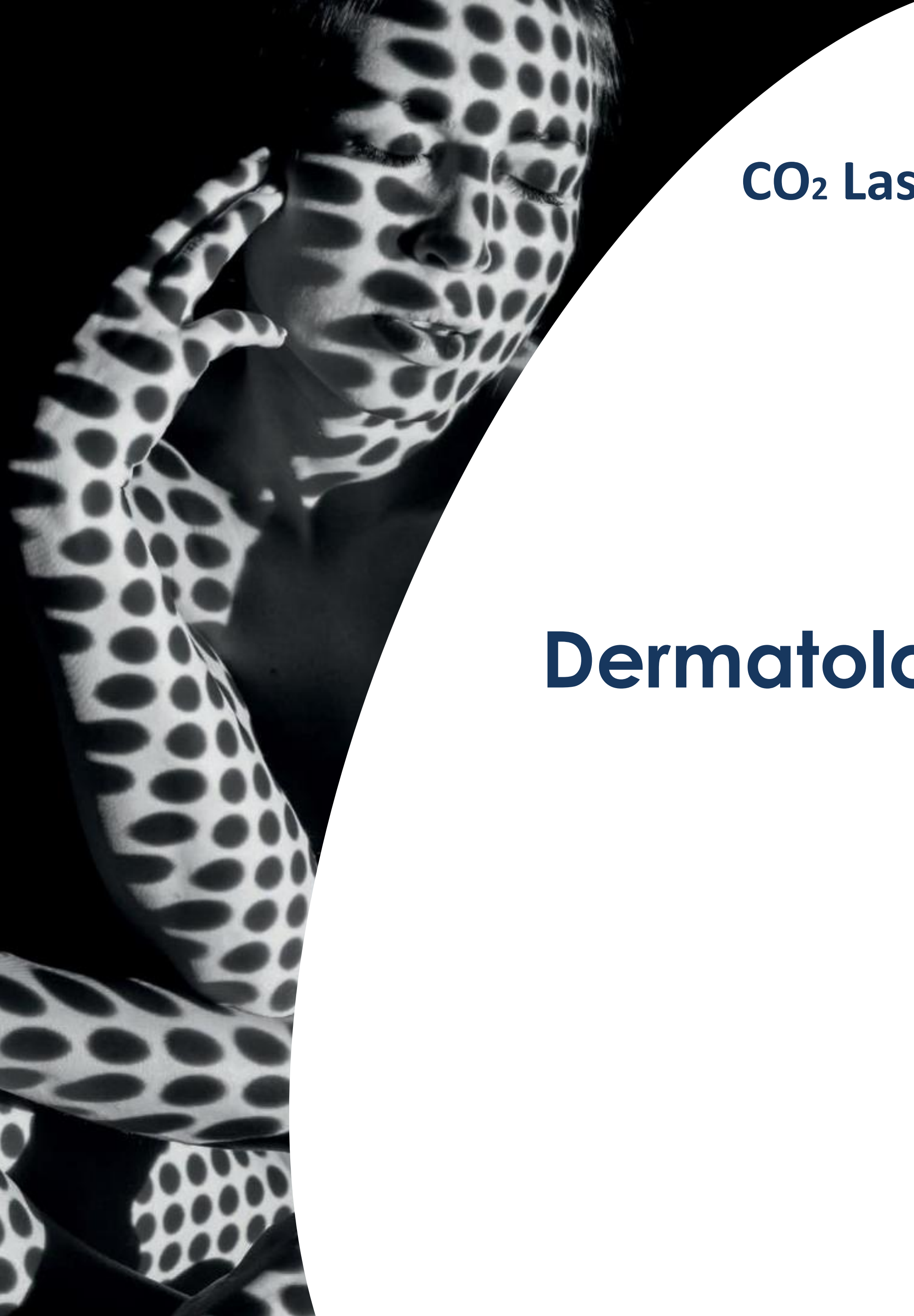
Figure 2. The typical erythema, immediately after the treatment session with the SmartXide DOT (DEKA-M.E.L.A., Calenzano, Italy) Fractional CO_2 laser device.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Seborrheic keratoses

Research Article

Highlights of Thirty-Year Experience of CO_2 Laser Use at the Florence (Italy) Department of Dermatology

Piero Campolmi, Paolo Bonan, Giovanni Cannarozzo, Andrea Bassi, Nicola Bruscino, Meena Arunachalam, Michela Troiano, Torello Lotti, and Silvia Moretti

The CO_2 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 system 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, and 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 see with older methods, using higher power. The percentage of after-treatment keloids and hypertrophic scars oberved 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 diathermocoagulatiopn 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.

Research Article

Highlights of Thirty-Year Experience of CO_2 Laser Use at the Florence (Italy) Department of Dermatology

Piero Campolmi, Paolo Bonan, Giovanni Cannarozzo, Andrea Bassi, Nicola Bruscino, Meena Arunachalam, Michela Troiano, Torello Lotti, and Silvia Moretti

Photobiomodulation, Photomedicine, and Laser Surgery
Volume 41, Number 7, 2023

Pp. 1–7
DOI: 10.1089/photob.2023.0015

Original Research

Clinical Evaluation and Experience in Treatments Performed with Fractional CO_2 Laser on Latin American Skin: An Observational Retrospective Study

Gabriella Benites Andrade, MD,[1] Pamela Montaño Salguero, MD,[1]
Irene Fusco, PhD,[2] and Daniel Ricardo Galimberti, MD[3]

Background: The carbon dioxide (CO2) laser is an ablative system that evaporates, remodels, and coagulates tissues, becoming therefore a gold standard piece of equipment for the treatment of dermatological pathologies and esthetic imperfections.

Objective: To evaluate the efficacy and safety of CO2 laser treatments in different patients' skin pathologies.

Methods: A total of 705 patients with an age range between 18 and 70 years, with phototypes on the Fitzpatrick scale III, IV, V, and VI, were enrolled from October 2021 to May 2022, and were treated using the CO2 laser system.

Results: Ninety-six patients were treated with fractional CO2 laser, used for skin rejuvenation and stretch marks. One patient presented reactivation of herpes simplex, 10 postinflammatory hyperpigmentation that resolved after 3 months with depigmenting agents, 6 with persistent erythema. A total of 13 patients with rhinophyma were treated, and no complications were observed; a total of 64 patients with wrinkles were treated. They improved in 6 months. A total of 340 patients were treated for seborrheic keratosis, papulosa nigra dermatosis, fibropapillomas, sebaceous hyperplasias, verruca vulgaris, and condylomata acuminata. One patient presented with a complication hypopigmented macule. A total of 136 patients underwent treatment for laser ablation of intradermal nevi and verrucous epidermal nevi, without complications. A total of 56 patients were treated with keloids and hypertrophic scars. One patient presented with ulceration of a keloid that resolved with the application of clostridiopeptidase A and chloramphenicol after 2 weeks.

Conclusions: The use of the CO2 laser in any phototype and race, which are factors with a high incidence in Latin America, provides a safe and effective result for different dermatological pathologies

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Original Research

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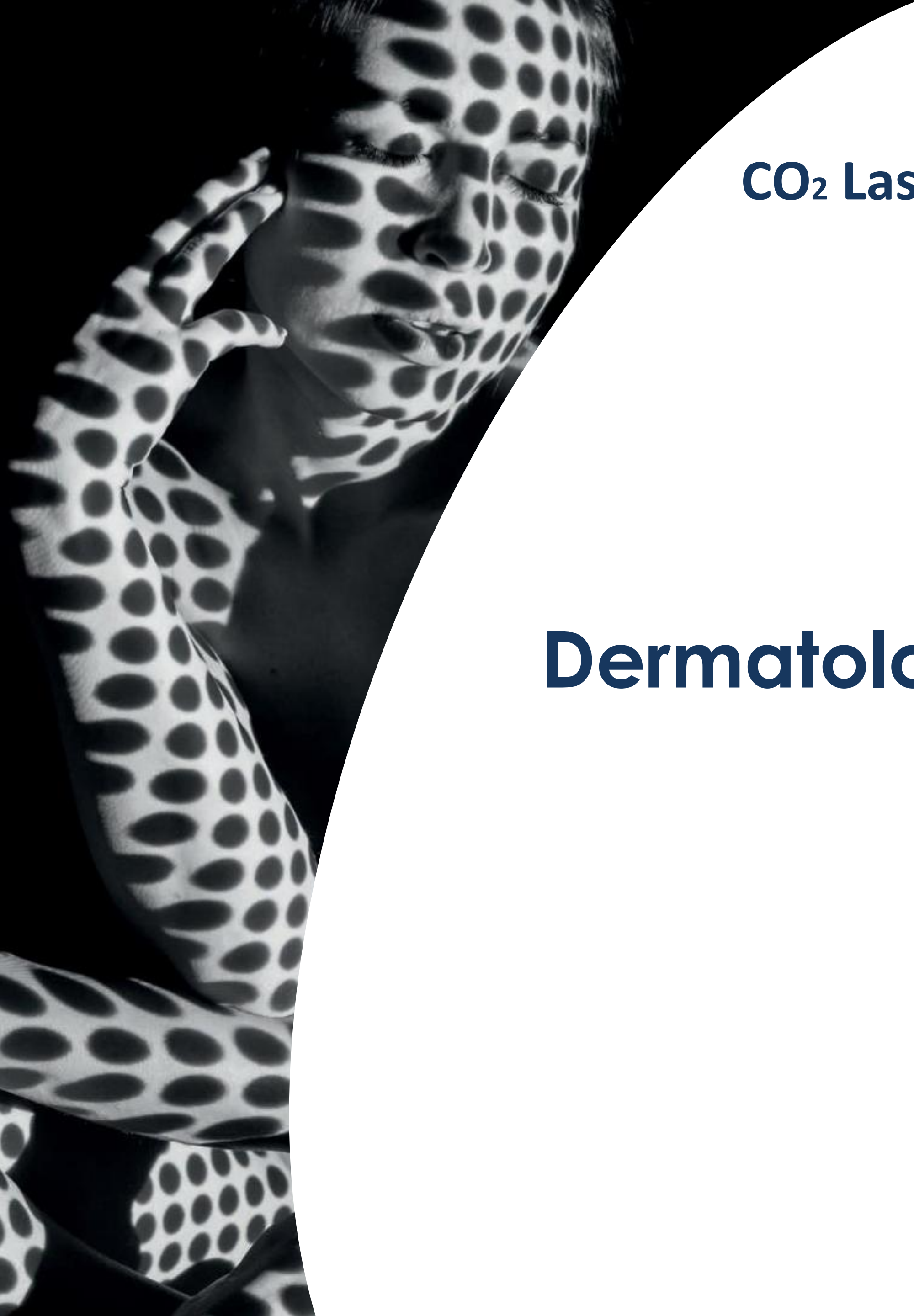
TABLE 1. PROCEDURES AND PATIENT PHOTOTYPE

Procedures	n	%
Free hand	—	—
Seborrheic keratoses	129	15.4
Dermatosis papulosa nigra	26	3.1
Sebaceous hyperplasia	12	1.4
Syringomas	37	4.4
Warts	94	11.2
Accuminate condylomas	69	8.2
Verrucous epidermal nevi	74	8.8
Intradermal nevus	62	7.4
Fibropapillomas	10	1.2
Xanthelasmas	27	3.2
Rhynophymas	13	1.6
Fractional scanner	—	—
Acne, striae	121	14.5
Keloids, hypertrophic scar	56	6.7
Wrinkles, texture, pores, sup. pigment	107	12.8
Total	**837**	**100**
Patient phototype		
III	169	24.0
IV	226	32.1
V	218	30.9
VI	92	13.0
Total	**705**	**100**

Figure 2: Frontal view of a male patient before **(A)** and after **(B)** Glide CO2 laser treatment. A visible improvement of seborrheic keratosis was observed.
For seborrheic keratosis emission mode HP (power 0.5-2W) was selected.



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CO_2 Laser in Dermatological Applications

Dermatological Surgery

Actinic keratoses

Randomized, Controlled Trial of Fractional Carbon Dioxide Laser Resurfacing Followed by Ultrashort Incubation Aminolevulinic Acid Blue Light Photodynamic Therapy for Actinic Keratosis

MACRENE ALEXIADES, MD, PHD*†

BACKGROUND Aminolevulinic acid (ALA) photodynamic therapy (PDT) is an established treatment option for actinic keratosis (AK), and recently fractional carbon dioxide (CO2) laser was shown to improve outcomes; but studies of short incubation photosensitizer are lacking.

OBJECTIVE Assess the efficacy of short incubation ALA followed by blue light PDT with and without previous fractional CO2 treatment for the treatment of AK.

METHODS Randomized, paired split-design, controlled trial of fractional CO2 followed by ultrashort 15-minute versus 30-minute incubation ALA and blue light PDT for the treatment of AK on the face.

RESULTS The complete clearance rates (CRs) at 8 weeks after ALA PDT with and without FxCO2 at 30- and 15-minute ALA incubation times were 89.78% (+FxCO2) versus 71.20% CR (2FxCO2) at 309, and 86.38% (+FxCO2) versus 69.23% (2FxCO2) at 159 ALA incubation. All lesion improvements were statistically significant.

CONCLUSION This randomized, comparative paired group controlled clinical study demonstrates that ultrashort 15- and 30-minute incubation ALA PDTs are of limited efficacy for the treatment of AK. Pretreatment with fractional ablative resurfacing yields statistically significant greater AK clearance with ALA-PDT at ultrashort ALA incubations followed by blue light.

Randomized, Controlled Trial of Fractional Carbon Dioxide Laser Resurfacing Followed by Ultrashort Incubation Aminolevulinic Acid Blue Light Photodynamic Therapy for Actinic Keratosis

Macrene Alexiades, MD, PhD*†

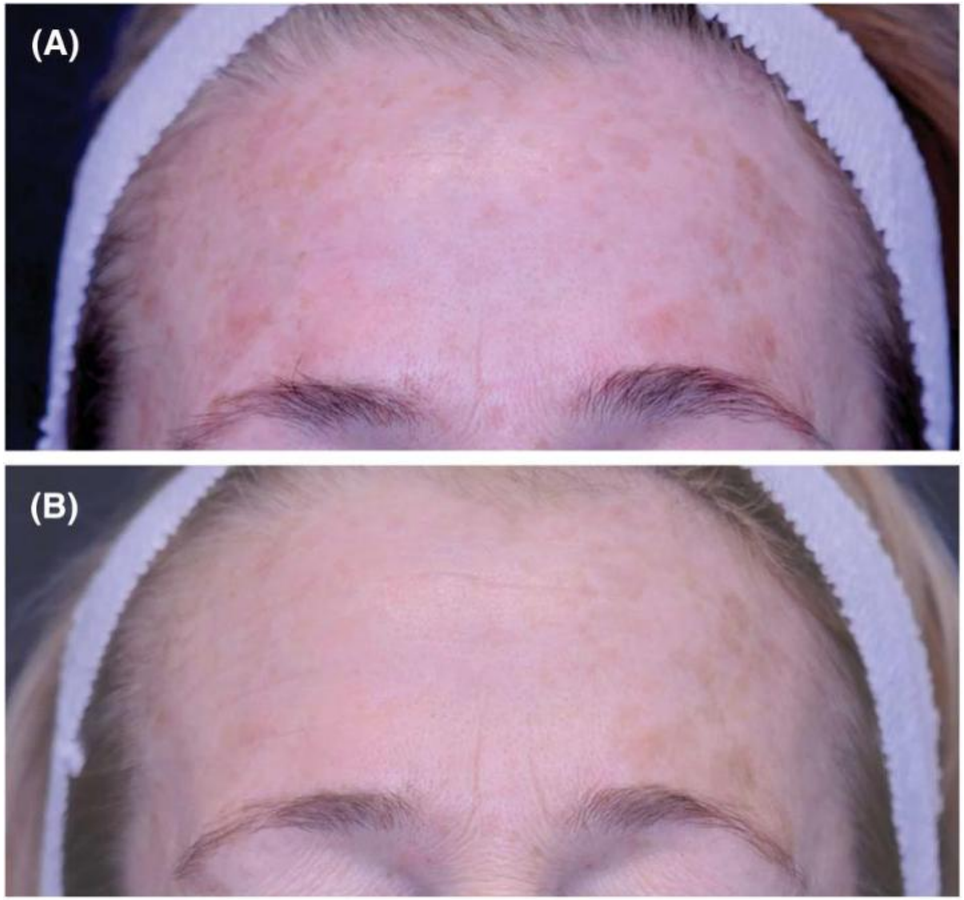

Figure 3. Baseline and 8-week follow-up of subject randomized to pretreatment with FxCO2 to Right and 30-minute aminolevulinic acid incubation with blue light.
The 2 sides of the face display comparable actinic keratosis (AK) counts and photodamage at baseline (left). Greater improvement in AK clearance rate and post-treatment cosmesis is evident on the right in the post-treatment photograph (right).

Randomized, Controlled Trial of Fractional Carbon Dioxide Laser Resurfacing Followed by Ultrashort Incubation Aminolevulinic Acid Blue Light Photodynamic Therapy for Actinic Keratosis

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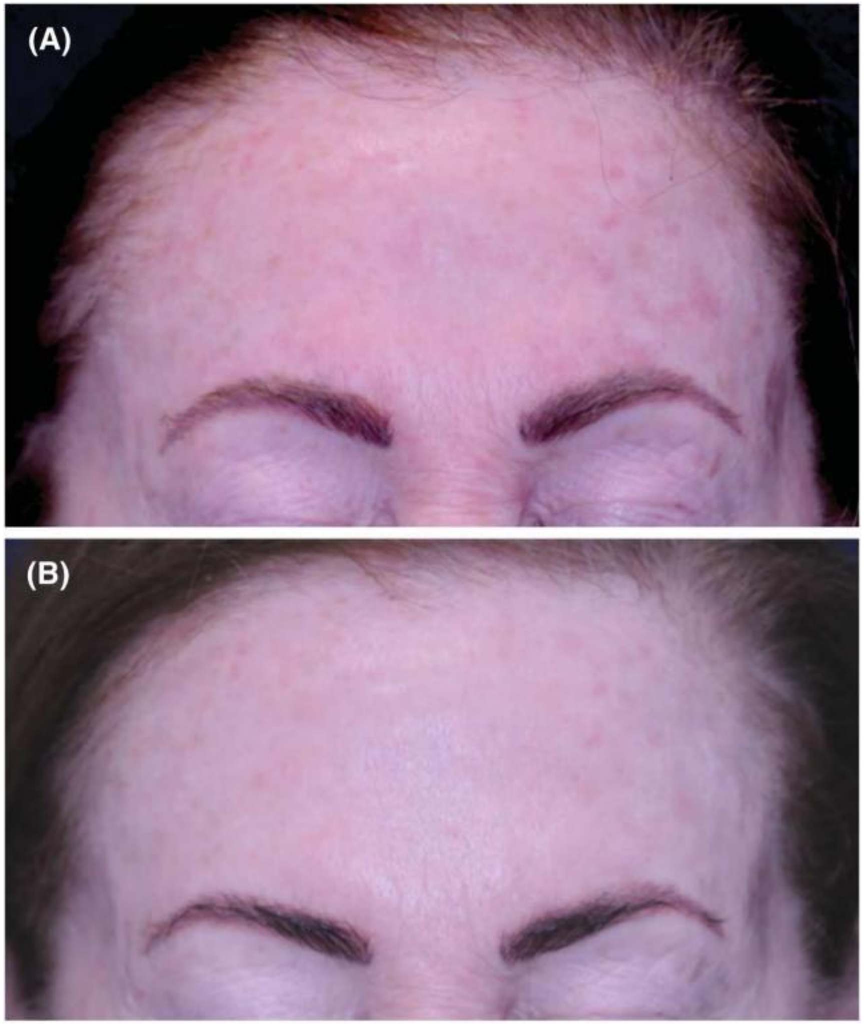
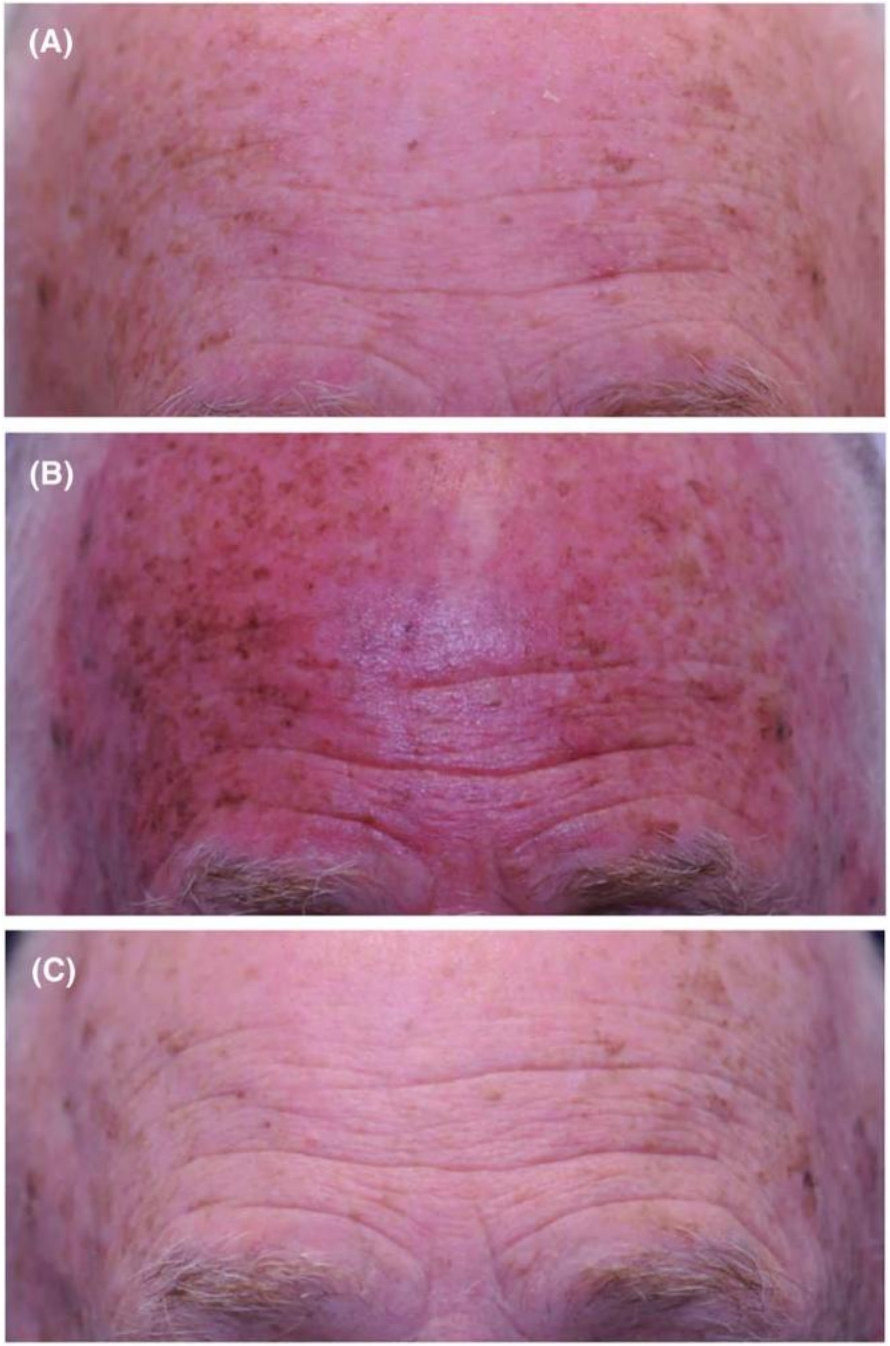


Figure 4. Baseline and 8-week follow-up of subject randomized to pretreatment with FxCO2 to Left and 15-minute aminolevulinic acid incubation with blue light. The 2 sides of the face display comparable actinic keratosis (AK) counts and photodamage at baseline (left). Greater improvement in AK clearance rate and post-treatment cosmesis is evident on the left in the post-treatment photograph (right).



Randomized, Controlled Trial of Fractional Carbon Dioxide Laser Resurfacing Followed by Ultrashort Incubation Aminolevulinic Acid Blue Light Photodynamic Therapy for Actinic Keratosis

MACRENE ALEXIADES, MD, PHD*†

Figure 5. Postoperative recovery after +/2FxCO2 aminolevulinic acid (ALA) photodynamic therapy. The baseline, 1-day and 8-week follow-up photographs from a subject randomized to pretreatment with FxCO2 to the right and 30 minutes ALA blue light treatment.
(A) Baseline: Demonstrating actinic keratosis (AK) on forehead.
(B) One day postoperative: demonstrating moderate erythema which is more prominent on the right.
(C) Eight-week follow-up:demonstrating greater AK clearance rate on right versus left.

European Journal of Inflammation

Letter to the editor

European Journal of Inflammation
2016, Vol. 14(3) 200–205

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Ablative fractional laser improves treatment of actinic keratoses with Ingenol Mebutate

Steven Nisticò,[1,2] Mario Sannino,[1] Ester Del Duca,[1]
Federica Tamburi,[3] Ugo Bottoni[2] and Giovanni Cannarozzo[1]

Actinic keratoses (AK) are pre-neoplastic lesions related to an excessive ultraviolet exposure that represent an emerging issue in the treated area of skin diseases which undergo high risk for developing squamous cell carcinoma (SCC).

In this open study, we tested the safety efficacy profile of sequential ablative laser and Ingenol Mebutate gel (ingMeb). Thirteen patients with a total of 99 lesions were selected for this open study. When multiple lesions in the same area were found, the treatment area was split in half. In one group, fractional CO2 laser microablative treatment was performed the day before three daily applications of IngMeb 150 Ig/g; the other group received IngMeb without previous laser ablation. Fifty-six lesions were treated with laser and a total of 43 lesions in the second group were treated with IngMeb alone. Results at the 12-week follow-up visit showed that a clearance rate of 50/56 (89.2%) had been achieved. On the side that was not pre-treated with laser, 31 out of 43 lesions were cleared (72.1%). In our opinion, ablative fractional laser treatment could improve topical treatment of AKs, or provide a further therapeutic option for resistant patients.

European Journal of Inflammation

Letter to the editor

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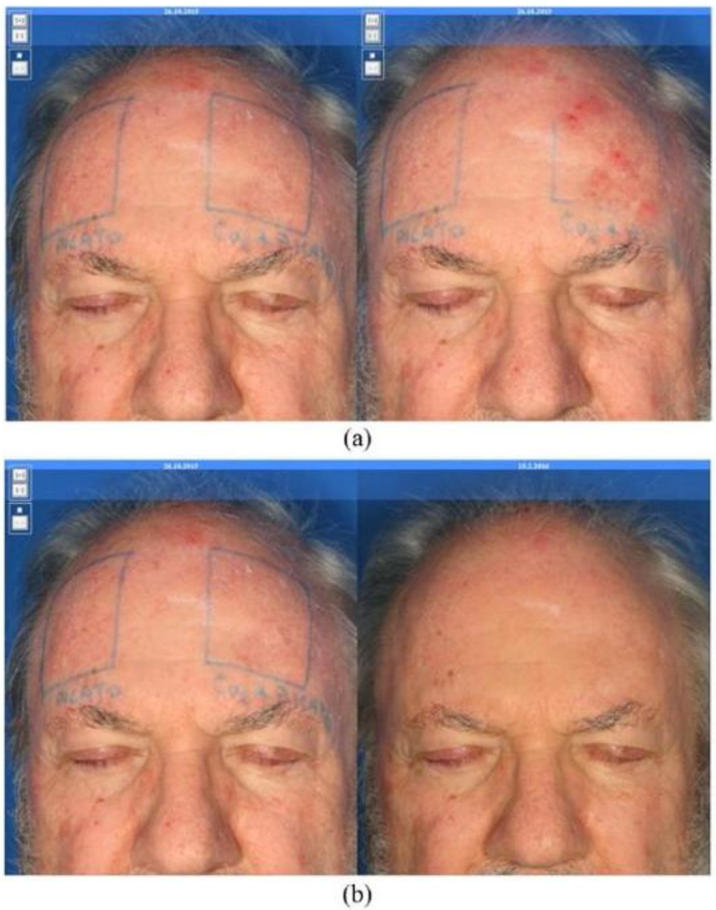
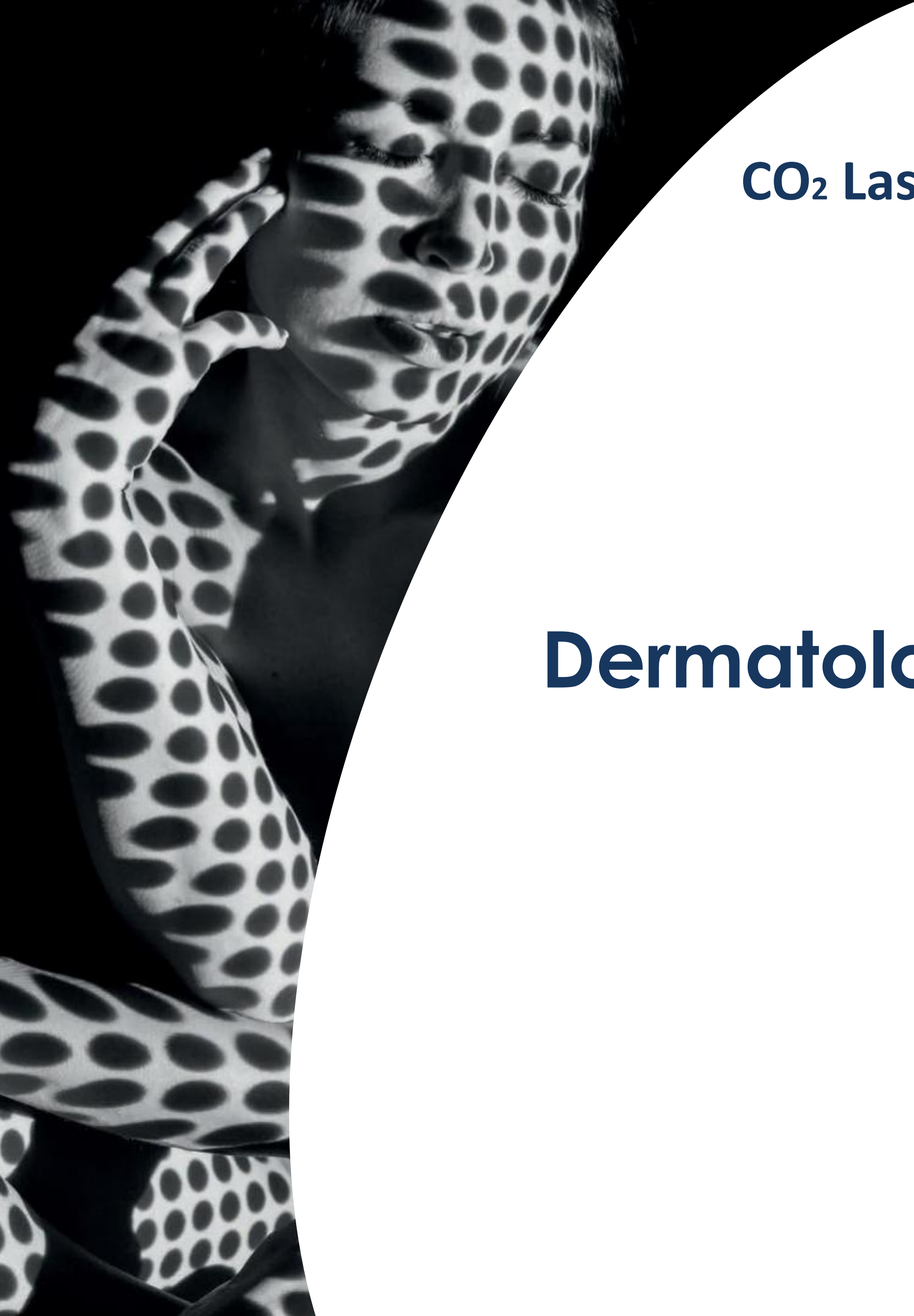


Figure 2. (a) (Left) patient before treatment (T0), (right) patient after the first treatment. (b) (Left) patient before treatment (T0), (right) patient at 3-month follow-up.

One side underwent field ablative fractional CO_2 laser treatment the day before field application of IngMeb 150 lg/g (daily, for 3 consecutive days on a 25 cm2 area), the other side was treated with daily field application of 150 lg/g IngMeb for the same 3 days.

Ablative fractional CO_2 laser was performed using the following settings; 10W, Hp Pulse, SmartTrack, 400 µm spacing.

Medication with ice cold gauzes and antibacterial cream (fucidic acid) was applied immediately after treatment.



Dermatological Surgery

Inverted follicular keratosis

Research Article

Highlights of Thirty-Year Experience of CO_2 Laser Use at the Florence (Italy) Department of Dermatology

Piero Campolmi, Paolo Bonan, Giovanni Cannarozzo, Andrea Bassi, Nicola Bruscino, Meena Arunachalam, Michela Troiano, Torello Lotti, and Silvia Moretti

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Research Article

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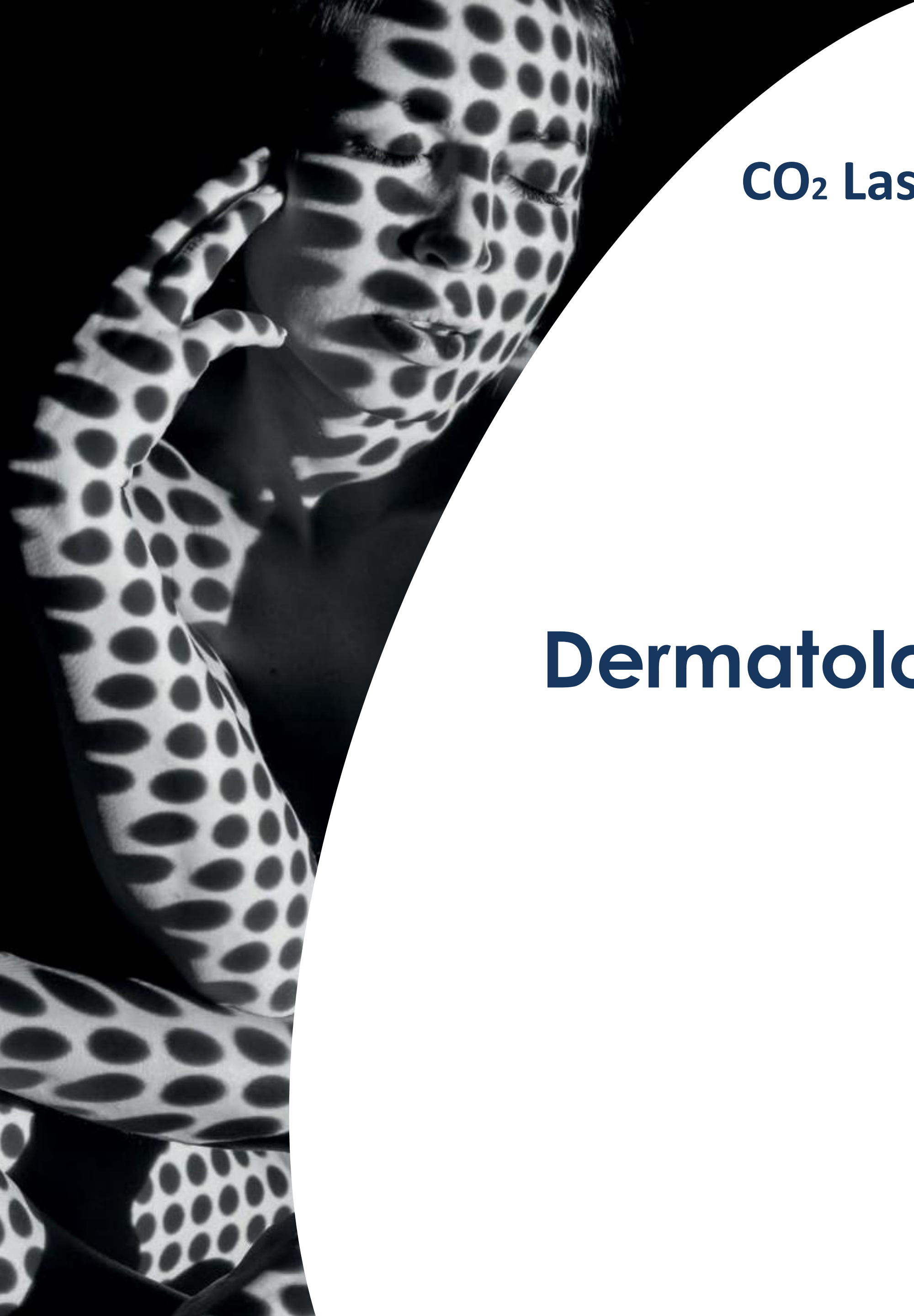
Table 1: Treated lesions.

Benign epidermal tumours Seborrheic keratoses Follicular inverse keratoses Epidermal and sebaceous nevi	35.720 75 5706	Frequency: 10 HZ Power: 0.5–3 W
Benign pilar and sebaceous tumours Facial Milia Trichoepitheliomas Sebaceous adenoma Small sebaceous cysts	12.230 2.570 8.040 425	Frequency: 10 HZ Power: 0.5–1 W
Benign tumours of eccrine glands Syringomas	1235	Frequency: 10 HZ Power: 0.5–1 W
Malign epidermal tumours Basal Cell carcinoma (Bcc) Superficial (also extensive) Nodular (<1 cm diameter)	2505	Frequency: 10 HZ Power: 0.5–5 W
Viral lesions Warts Acuminate condylomas Squamous papillomas Oral cavity	12.235 8.503 58	Frequency: 10 HZ Power: 0.5–3 W For Plantar Warts: Continuous Mode (Power 10–15 W)
Dermal hypertrophy Pendulous fibromas Skin neurofibromas	45.023 150	Frequency: 10 HZ Power: 0.5–1 W
Scars Acne, surgical, traumatic, post-chickenpox	7.502	Frequency: 10 HZ Power: 0.5–1 W
Fatty accumulation Xanthelasmas	7.234	Frequency: 10 HZ Power: 0.5–1 W
Facial dermatosis Rhynophymas (glandular type) Otophyma	506 35	Frequency: 50–100 W Power: 6-7 W (Superpulse or Continuous Mode)
Precancerous Actinic keratoses Actinic cheilitis Leukoplakia	25.213 807 503	Frequency: 10 HZ Power: 0.5–3 W
Others Favre-Racouchot's disease Pringle-Bourneville's disease Chondrodermatites nodularis helicis	124 304 432	Frequency: 10 HZ Power: 0.5–1 W

(a) (b)

Figure 9: Inverted follicular keratosis at first (a) and after (b) one treatment with CO_2 laser.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Warts

medicina MDPI

Article

Sequential Use of CO_2 Laser Prior to Nd:YAG and Dye Laser in the Management of Non-Facial Warts: A Retrospective Study

Luigi Bennardo [1,†], Gaia Fasano [1,†], Federica Tamburi [1], Elena Zappia [1], Francesco Rizzuto [1], Steven Paul Nisticò [1,*] and Giovanni Cannarozzo [2]

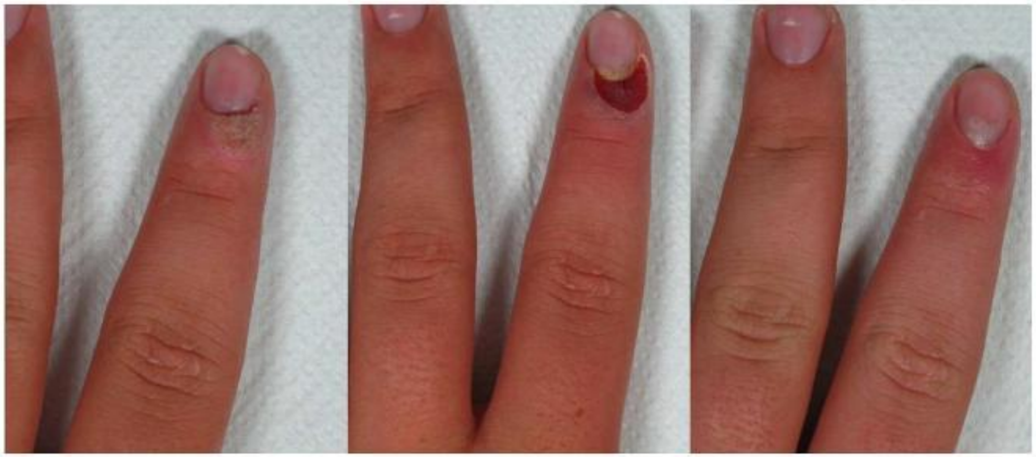


Figure 1. Patient n. 3 before treatment (**left**), during laser therapy (**central**), and 4 months after treatment (**right**).

Figure 4. Patient n. 27 before treatment (**left**), immediately after combined treatment (**central**), and 4 months after treatment (**right**).

This article proposed a combined treatment using a **first pass of CO2 laser**, used to substitute keratolytic therapies to expose superficial dermis and the viral lesions, followed by a **second pass of vascular laser** to reduce the vascular afflux to the area, necrotize viral warts, and reduce the relapse rate.

Pulsed dye laser was used in the area where the skin was thin, and **Nd:YAG** in the areas with thicker skin, with an optimal result;

The advantages of using the CO2 laser are the *precision in the depth of ablation* that does not damage the adjacent tissues, the quickness in case of multiple lesions, and theabsence of bleeding.

medicina

Article

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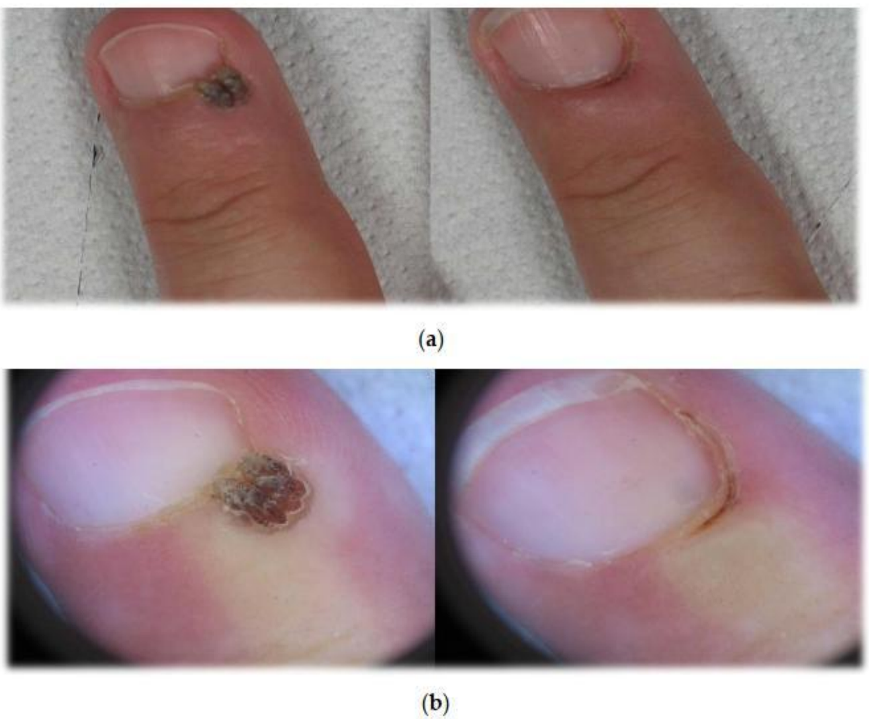

Figure 2. (**b**) Patient n. 20 before treatment (**left**) and 1 month after treatment (**right**) dermatoscopic view; (**a**) patient n. 20 before treatment (**left**) and 1 month after treatment (**right**).

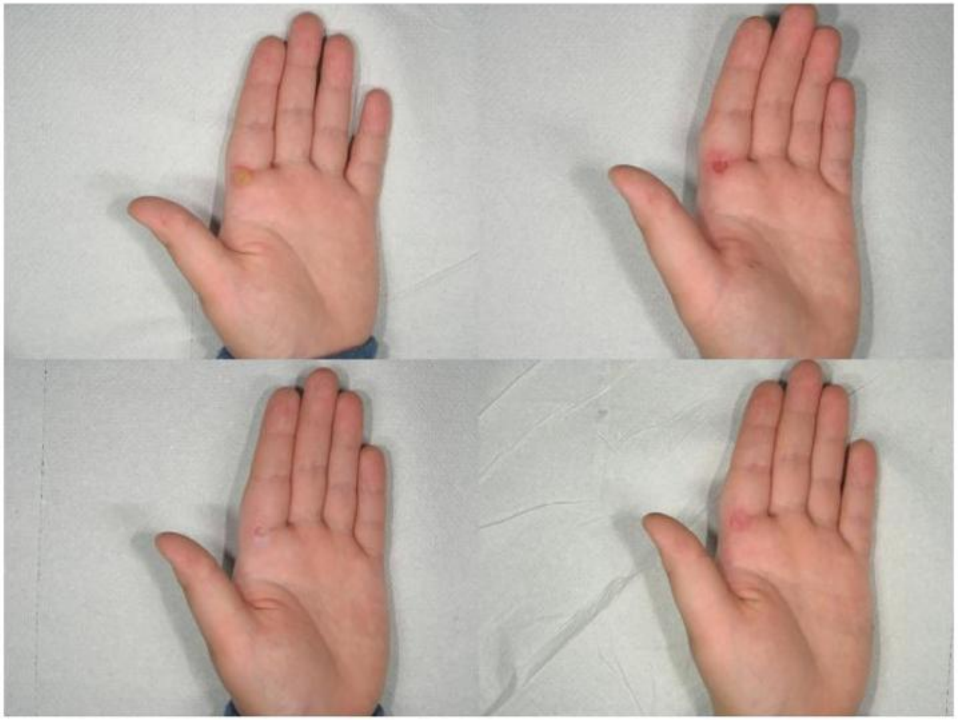

Figure 5. Patient n. 19 before treatment (**upper left**), immediately after CO_2 treatment (**upper right**), immediately after combined treatment (**lower left**), and 1 month after treatment (**lower right**).

DERMATOLOGY PRACTICAL & CONCEPTUAL
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Cryotherapy versus CO_2 laser in the treatment of plantar warts: a randomized controlled trial

Nahid Hemmatian Boroujeni[1], Farhad Handjani[1,2]

Background: Warts are one of the most common infections in humans. Plantar warts are a subtype of non-genital warts, and several procedures and topical treatments have been used in its treatment. Cryotherapy is one of the most popular modalities, but it is time-consuming and remission rates vary in different studies. CO2 laser was the first laser used for treating warts. To date, no clinical trial has been done to compare CO2 laser with cryotherapy in the treatment of plantar warts.

Patients and Methods: This randomized controlled trial was performed in order to compare the efficacy and number of sessions needed to treat plantar warts in 60 patients who had received no previous treatment in the previous 3 months. They were randomly allocated to the cryotherapy or CO2 laser group. The number of sessions needed for response and the recurrence rate after a 3-month follow-up was compared in the 2 groups.

Results: Sixty patients with plantar warts were randomly allocated to either the CO2 laser or cryotherapy groups. Median age was 25 (range=18-53) and 27 (range= 18-75) years in the cryotherapy group and CO2 laser groups, respectively. Both groups were matched for age and sex (56% male and 44% female in the cryotherapy group and 34% male and 66% female in the CO2 laser group). The median number of sessions needed for complete resolution of the warts in the CO2 laser and cryotherapy groups were 1 (range=1-2) and 3 (range=1-12), respectively. The difference in the number of sessions was statistically significant between the 2 groups (P-value≤0.001). Recurrence rates after a 3-month follow-up was not statistically significant (P-value= 0.069).

Conclusion: The number of sessions needed to treat plantar warts was less using CO2 laser than cryotherapy; therefore, this modality can be a good addition to the already existing anti-wart armamentarium.

DERMATOLOGY PRACTICAL & CONCEPTUAL
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Cryotherapy versus CO_2 laser in the treatment of plantar warts: a randomized controlled trial

Nahid Hemmatian Boroujeni[1], Farhad Handjani[1,2]

Figure 1: Phases of treatment in one patient who underwent **CO2 laser** therapy (a) before laser therapy; (b) immediately after therapy; (c) 1 week after therapy.

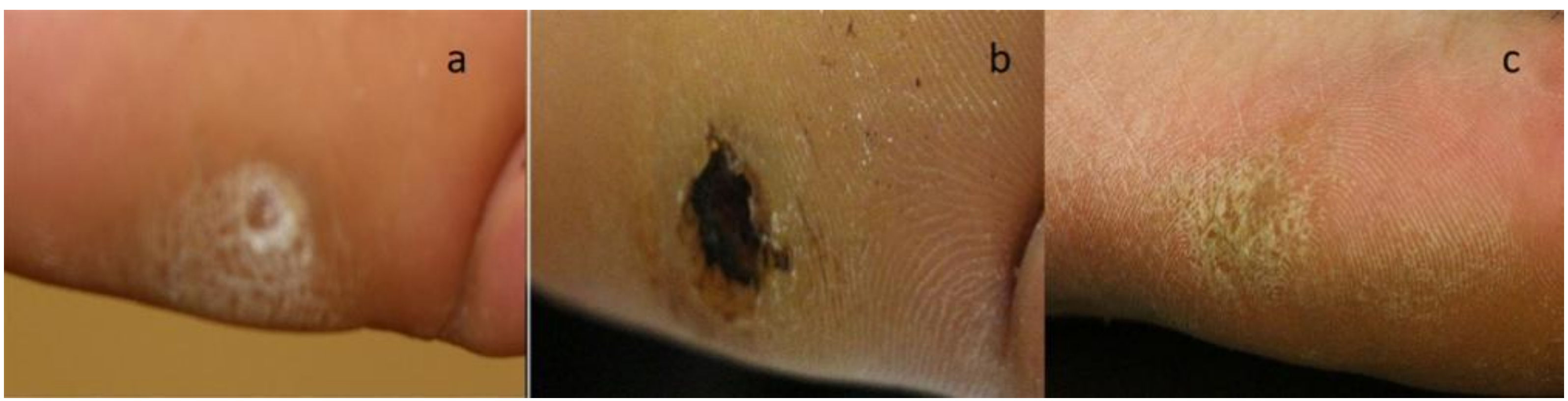

Figure 2: Phases of treatmentin another patient in the **CO2 laser** group (a) before laser therapy; (b) immediately after therapy; (c) 3 months after therapy

DERMATOLOGY PRACTICAL & CONCEPTUAL
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Cryotherapy versus CO_2 laser in the treatment of plantar warts: a randomized controlled trial

Nahid Hemmatian Boroujeni[1], Farhad Handjani[1,2]

Figure 3. Phases of treatment in a patient who underwent **cryotherapy** (a) before cryotherapy; (b) cryotherapy after 6 sessions; (c) cryotherapy after 11 sessions.

Figure 4. Phases of treatment in another patient in the **cryotherapy** group (a) before cryotherapy; (b) cryotherapy after 6 sessions; (c) cryotherapy after 12 sessions; failure of treatment.

DOI: 10.1111/jdv.12029 JEADV

ORIGINAL ARTICLE

Efficacy and safety evaluation of an innovative CO_2 laser/radiofrequency device in dermatology

P. Campolmi, P. Bonan, G. Cannarozzo, N. Bruscino,* S. Moretti

Background: CO2 laser has not only become the most widely used laser in dermatological surgical practice, but it has also proved to be highly effective in treating aesthetic imperfections.

Objective: To examine the efficacy and safety of a novel fractional CO2 laser combined with a radiofrequency device in different dermatological, surgical and aesthetic fields.

Methods: A total of 79 patients were treated in our Outpatient Service with a novel fractional CO2 laser combined with a bipolar radiofrequency device for a maximum of 5 months. Group A consisted of 39 patients with lesions requiring complete excision, whereas Group B consisted of 40 subjects seeking to enhance aesthetic facial imperfections. The results were assessed by three 'blind' investigators using photographs and clinical observations; in addition, the patients had to give their own subjective assessment of the results.

Results: At the 6-month follow-up, the lesions of the Group A patients had been completely removed, except for one case of a large sebaceous nevus on the scalp. All the Group B patients showed global improvement in skin tightening, removal of fine lines and rhytides and correction of dilated pores and hyperpigmentation, with no significant side-effects and short downtimes.

Conclusion: This kind of laser meets the needs of the majority of dermatologists requiring a unique, versatile tool to remove cutaneous lesions and at the same time, safely and effectively treat skin imperfections.

Research Article

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Piero Campolmi, Paolo Bonan, Giovanni Cannarozzo, Andrea Bassi, Nicola Bruscino, Meena Arunachalam, Michela Troiano, Torello Lotti, and Silvia Moretti

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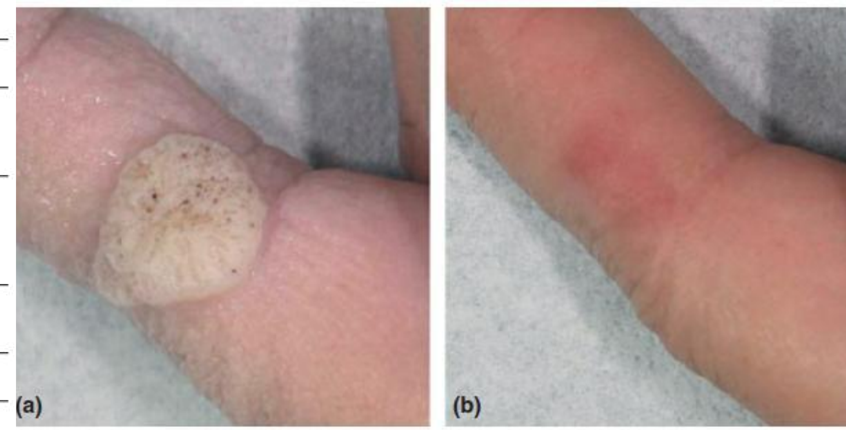
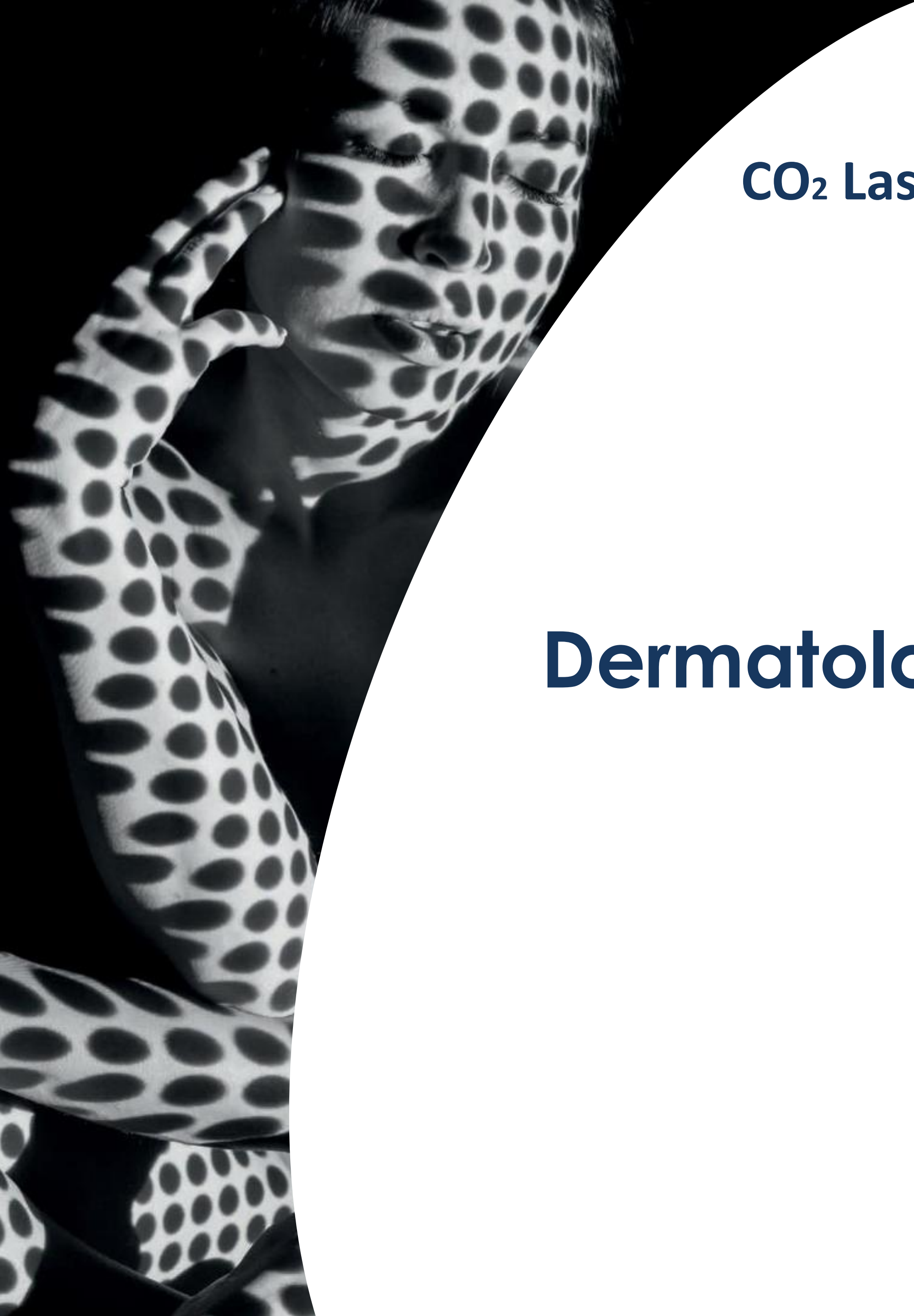
Viral lesions Warts Acuminate condylomas Squamous papillomas Oral cavity	12.235 8.503 58	Frequency: 10 HZ Power: 0.5–3 W For Plantar Warts: Continuous Mode (Power 10–15 W)
Dermal hypertrophy Pendulous fibromas Skin neurofibromas	45.023 150	Frequency: 10 HZ Power: 0.5–1 W
Scars Acne, surgical, traumatic, post-chickenpox	7.502	Frequency: 10 HZ Power: 0.5–1 W
Fatty accumulation Xanthelasmas	7.234	Frequency: 10 HZ Power: 0.5–1 W
Facial dermatosis Rhynophymas (glandular type) Otophyma	506 35	Frequency: 50–100 W Power: 6-7 W (Superpulse or Continuous Mode)
Precancerous Actinic keratoses Actinic cheilitis Leukoplakia	25.213 807 503	Frequency: 10 HZ Power: 0.5–3 W
Others Favre-Racouchot's disease Pringle-Bourneville's disease Chondrodermatites nodularis helicis	124 304 432	Frequency: 10 HZ Power: 0.5–1 W





Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Xanthelasma

Research Article

Highlights of Thirty-Year Experience of CO_2 Laser Use at the Florence (Italy) Department of Dermatology

Piero Campolmi, Paolo Bonan, Giovanni Cannarozzo, Andrea Bassi, Nicola Bruscino, Meena Arunachalam, Michela Troiano, Torello Lotti, and Silvia Moretti

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 system 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, and 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 see with older methods, using higher power. The percentage of after-treatment keloids and hypertrophic scars oberved 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 diathermocoagulatiopn 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.

Research Article

Highlights of Thirty-Year Experience of CO_2 Laser Use at the Florence (Italy) Department of Dermatology

Piero Campolmi, Paolo Bonan, Giovanni Cannarozzo, Andrea Bassi, Nicola Bruscino, Meena Arunachalam, Michela Troiano, Torello Lotti, and Silvia Moretti

TABLE 1: Treated lesions.

Benign epidermal tumours Seborrheic keratoses Follicular inverse keratoses Epidermal and sebaceous nevi	35.720 75 5706	Frequency: 10 HZ Power: 0.5–3 W
Benign pilar and sebaceous tumours Facial Milia Trichoepitheliomas Sebaceous adenoma Small sebaceous cysts	12.230 2.570 8.040 425	Frequency: 10 HZ Power: 0.5–1 W
Benign tumours of eccrine glands Syringomas	1235	Frequency: 10 HZ Power: 0.5–1 W
Malign epidermal tumours Basal Cell carcinoma (Bcc) Superficial (also extensive) Nodular (<1 cm diameter)	2505	Frequency: 10 HZ Power: 0.5–5 W
Viral lesions Warts Acuminate condylomas Squamous papillomas Oral cavity	12.235 8.503 58	Frequency: 10 HZ Power: 0.5–3 W For Plantar Warts: Continuous Mode (Power 10–15 W)
Dermal hypertrophy Pendulous fibromas Skin neurofibromas	45.023 150	Frequency: 10 HZ Power: 0.5–1 W
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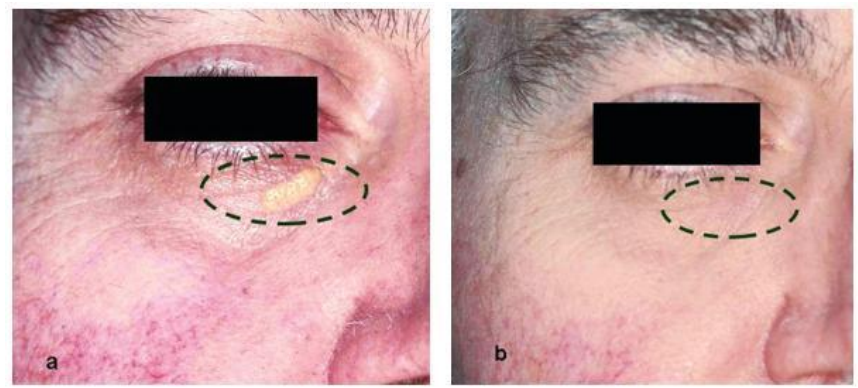
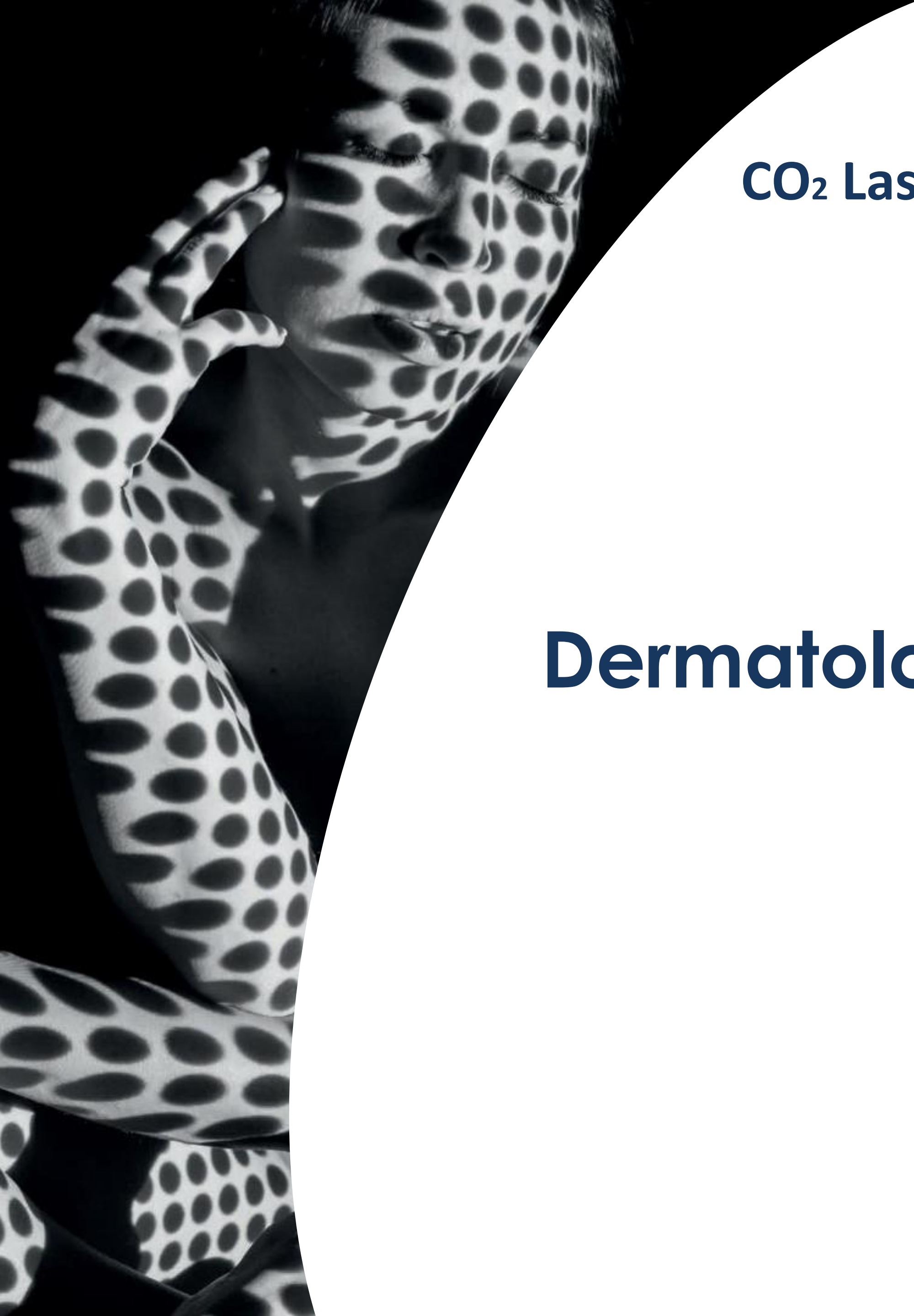


(a) (b)

FIGURE 8: Xanthelasma at first (a) and after (b) one treatment with CO_2 laser.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Cutaneous Neurofibromas in Von Recklinghausen's Disease

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DOI: 10.1111/dth.15355

DERMATOLOGIC THERAPY WILEY

LETTER

Pulsed dye laser prior to CO_2 laser ablation to treat multiple cutaneous neurofibromas in von Recklinghausen's disease: A case report

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Mario Sannino[1]
Giovanni Cannarozzo[1]
Luigi Bennardo[2]
Steven Paul Nisticò[2]

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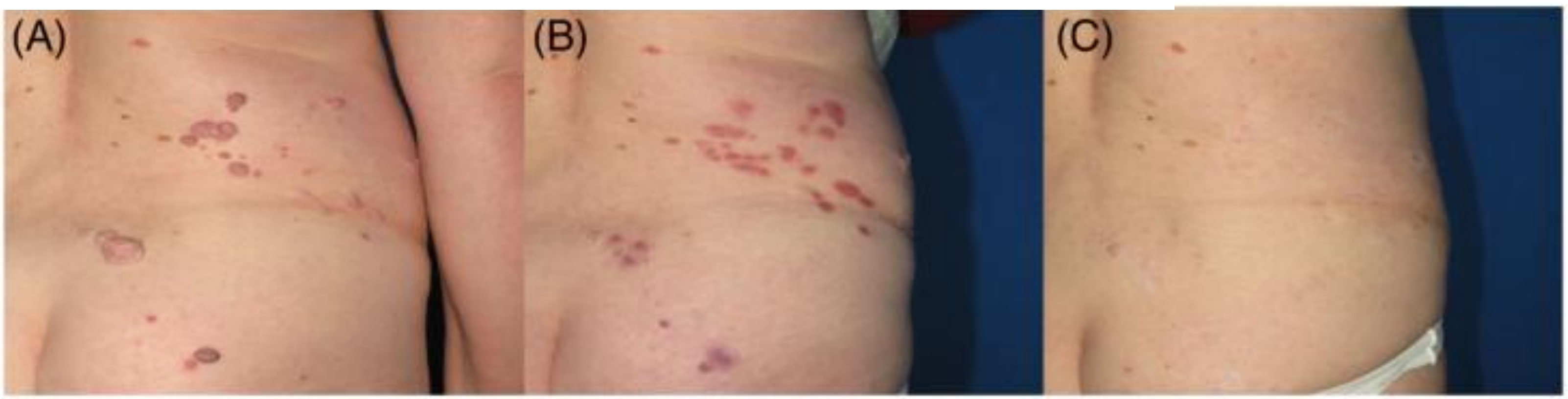
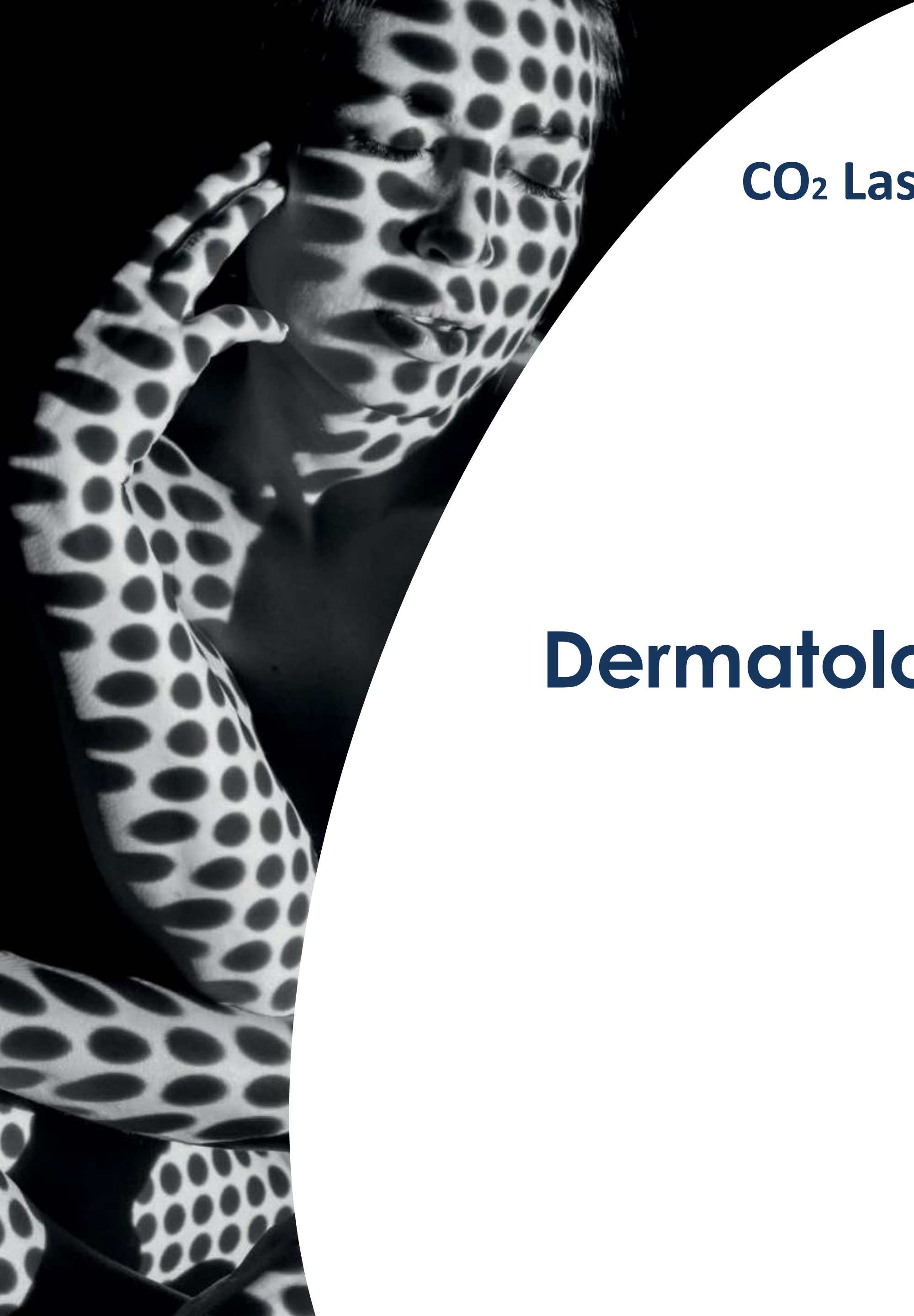


FIGURE 1 (A) Patient before treatment, lower right limb, (B) patient right after combination treatments, and (C) patient after all treatments

The patient was treated with PDL/CO_2 laser ablation combination therapy.
PDL was performed 2 weeks prior to CO_2 vaporizations and immediately after as intralesional vaporization treatment to minimized scarring. For the small ones, PDL was performed as standalone technique.

PDL parameters: 12 mm spot size, Fluence 4-7 J/CM2, Frequency 0.5/s

CO_2 parameters: Focused beam of 0.1-0.2 mm, power 0.5-4W



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Basal Cell Carcinoma

Superpulsed CO_2 Laser Treatment of Basal Cell Carcinoma With Intraoperatory Histopathologic and Cytologic Examination

PIERO CAMPOLMI, MD,* BENEDETTA BRAZZINI, MD,* CARMELO URSO, MD,† ILARIA GHERSETICH, MD,* LUCIANO MAVILIA, MD,* JANA HERCOGOVA, MD,‡ AND TORELLO LOTTI, MD*

**Department of Dermatology, University of Florence, and †Dermatopathology Section, S.M. Annunziata Hospital, Florence, Italy, and ‡Department of Dermatology and Venereology, Charles University, 2nd Medical School, Prague, Czech Republic*

Background. CO2 laser is currently one of the most versatile and useful laser devices in dermatologic practice in the fields of both cosmetology and oncology. The CO2 laser in a superpulsed mode enables the operator to effect precise and adequate vaporization of the affected area, with the possibility to appreciate visually the depth achieved, and, when necessary, to perform histologic and cytologic examination of the surrounding skin.

Objective. To show superpulsed CO2 laser treatment of basal cell carcinoma.

Methods. One hundred forty patients presenting single, multiple, superficial, or nodular basal cell carcinoma (BCC) have been treated with the superpulsed CO2 laser. Before the laser treatment the lesion was subjected to cytologic examination by scraping; this examination was then repeated when the papillary dermis was clinically detectable, and again when the operator considered the BCC completely vaporized. In selected subjects, histopathologic examination was done three times (biopsies were obtained at the same time as the samples for the cytologic examination).

Results. Recovery time was fast, with good healing outcomes. After 3 years follow-up no recurrences were seen. The cytologic and histopathologic examinations showed BCC in the specimens obtained prior to and during laser therapy, but not in those obtained after laser therapy.

Conclusion. This technique causes minimal thermal cellular damage and no severe morphologic cellular alterations. Thus it permits an intraoperatory cytologic and histopathologic examination. Finally, this technique enables the operator to recognize the different skin levels removed by vaporization and to stop the vaporization as soon as unaffected dermis has been reached, as shown by intraoperatory cytologic and histopathologic examination.

Superpulsed CO_2 Laser Treatment of Basal Cell Carcinoma With Intraoperatory Histopathologic and Cytologic Examination

PIERO CAMPOLMI, MD,* BENEDETTA BRAZZINI, MD,* CARMELO URSO, MD,† ILARIA GHERSETICH, MD,* LUCIANO MAVILIA, MD,* JANA HERCOGOVA, MD,‡ AND TORELLO LOTTI, MD*

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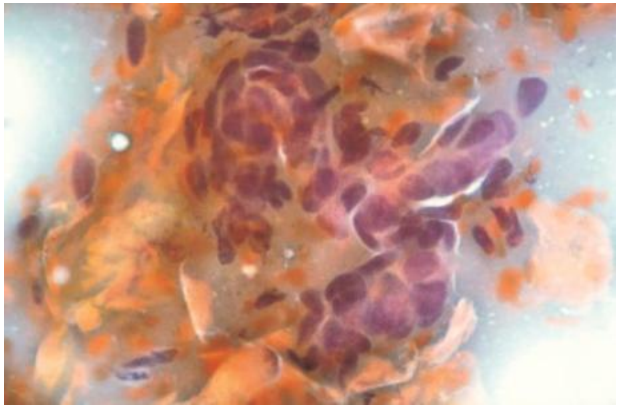

Figure 1. Cytologic preparation of scrapings from lesional skin. Note the group of squamous cells with hyperchromic enlarged nuclei of a BCC, blood cells, and many anuclear scales. (Papanicolaou; magnification 40.)

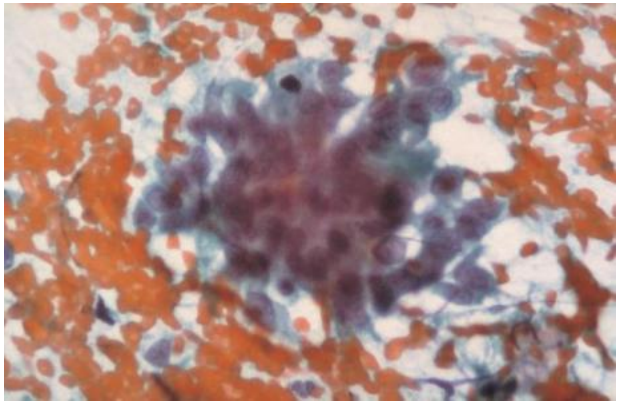

Figure 2. Cytologic preparation of scrapings from lesional skin after the first CO2 laser treatment. Note the group of scaled cells with large cytoplasm, enlarged nucleus from a BCC and blood cells. The scales are absent, eliminated by the first treatment. (Papanicolaou; magnification 40.)

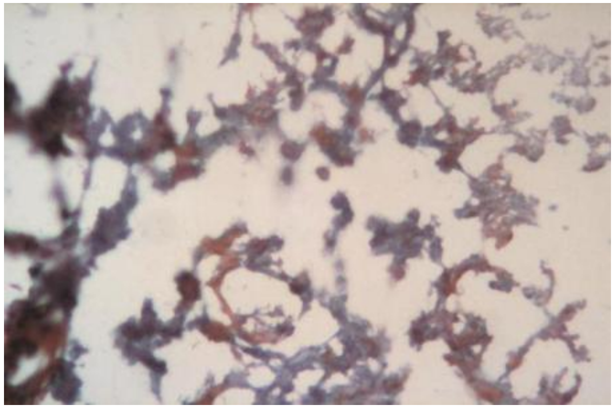

Figure 3. Cytologic preparation of scrapings from lesional skin after the second CO2 laser treatment. Note the absence of epithelial cells, blood cells, and amorphous material and cellular debris. (Papanicolaou; magnification 40.)

Superpulsed CO_2 Laser Treatment of Basal Cell Carcinoma With Intraoperatory Histopathologic and Cytologic Examination

PIERO CAMPOLMI, MD,* BENEDETTA BRAZZINI, MD,* CARMELO URSO, MD,† ILARIA GHERSETICH, MD,* LUCIANO MAVILIA, MD,* JANA HERCOGOVA, MD,‡ AND TORELLO LOTTI, MD*

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Figure 4. Basal cell carcinoma.

Figure 5. Flaming red surface with central bleeding (in the area corresponding to the tumor) surrounded by a pink peripheral area of 1–2 mm (unaffected skin) evident after the carbonized residue is removed

Figure 6. Yellowish surface with big beams of fibers similar to waterlogged cotton threads evident after further vaporization.

Lasers in Surgery and Medicine
ENERGY-BASED THERAPEUTICS AND DIAGNOSTICS

CLINICAL REPORTS

Combined CO_2 and dye laser technique in the treatment of outcomes due to flap necrosis after surgery for basal cell carcinoma on the nose

Steven Paul Nisticò MD[1] | Luigi Bennardo MD[1] | Mario Sannino MD[2] | Francesca Negosanti MD[3] | Federica Tamburi MD[1] | Ester Del Duca MD[1] | Amerigo Giudice MD[1] | Giovanni Cannarozzo MD[2]

FIGURE 1 Patient n.3 Atrophic and hypertrophic scarring after necrosis of the rotation flap in BCC treated with Mohs technique. Frontal (right) and lateral (central and left) projections. BCC, basal cell carcinoma

(**A**) Patient n.3 first, freehand vaporization with an ablative CO2 laser (0.3–2.5 W) of the area of sebaceous hyperplasia surrounding the scar tissue. Then, treatment of atrophic and hypertrophic scar tissue with a fractional CO2 laser (Power 14 W; Dwell Time 1.5 ms; Spacing 500 µm; mixed pulse SP and HP) and subsequent application of 595 nm Dye laser (Spot Size 12 mm; Pulse Duration 0.5 ms; Fluence 7 J/cm2). Frontal (right) and lateral (central and left) projections.

(**B**) Patient n.3 clinical aspect 25 days after the first session. Frontal (right) and lateral (central and left) projections.

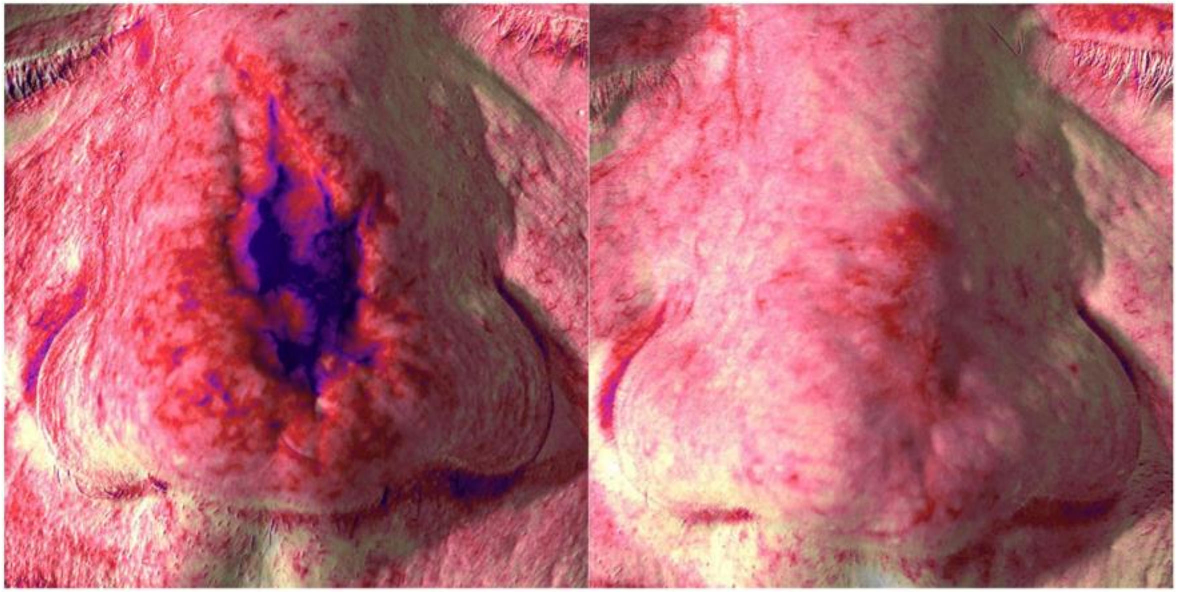
(**C**) Patient n.3 second treatment session. First, freehand vaporization with an ablative CO2 laser (0.3–1.5 W) of the area of sebaceous hyperplasia surrounding the scar tissue. Then, treatment of atrophic and hypertrophic scar tissue with a fractional CO2 laser (Power 12 W; Dwell Time 1.2 ms; Spacing 600 µm; mixed pulse SP and HP) and subsequent application of 595 nm Dye laser (Spot Size 12 mm; Pulse Duration 0.5 ms; Fluence 7 J/cm2). Frontal (right) and lateral (central and left) projections.

(**D**) Patient n.3 third treatment session. Parameters were slightly reduced: Freehand finishing vaporization with an ablative CO2 laser (0.3–0.8 W); scar treatment with a fractional CO2 laser (Power 10 W; Dwell Time 1.2 ms; Spacing 500 µm; mixed pulse SP and HP).

Patient n.3 before any laser procedures.

Patient n.3 after all procedures.

Patient n.3:
Hemoglobin analysis (upper part of the figure) before (right) and after (left) treatment.



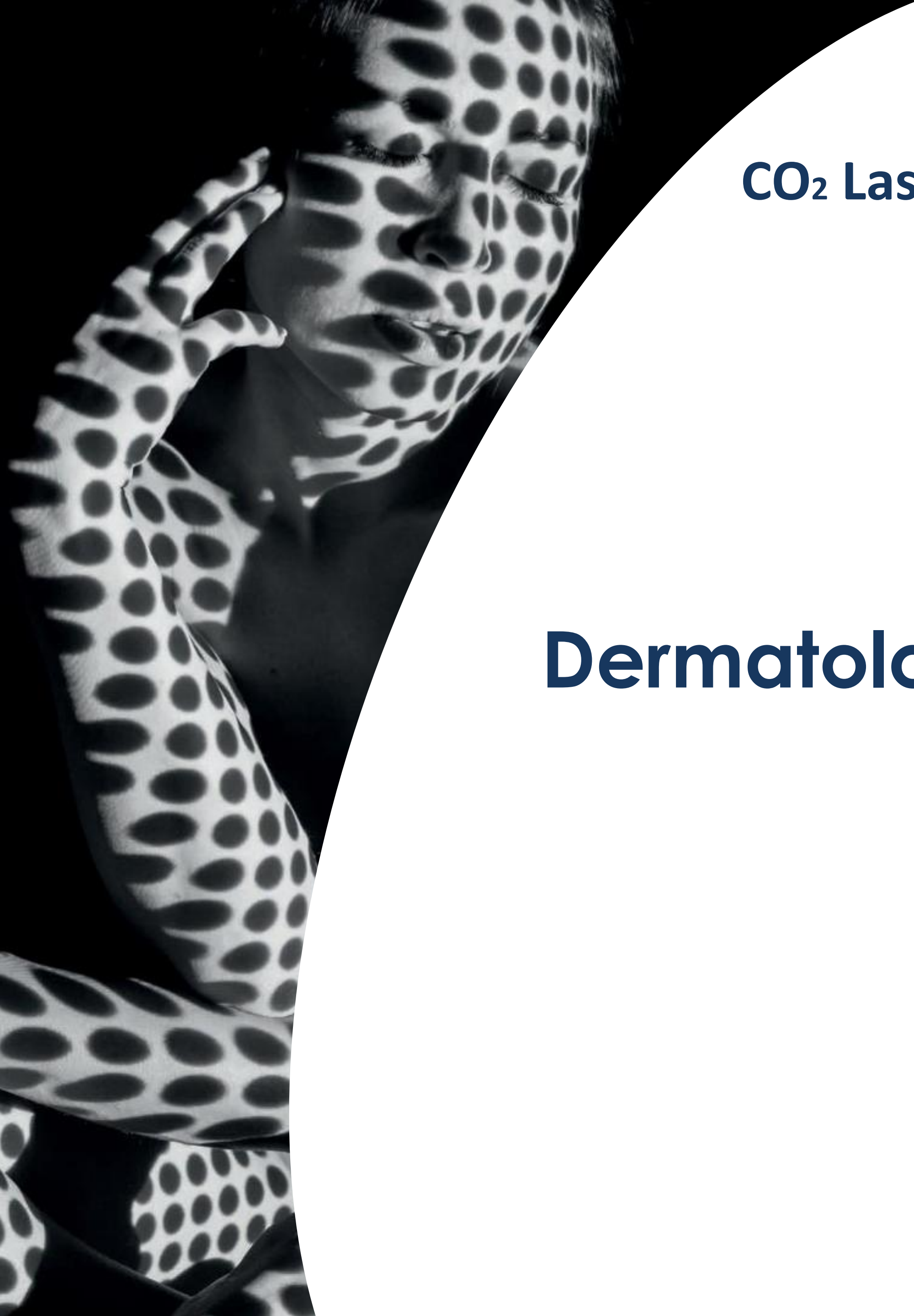
3D analysis (lower part of the figure) before (right) and after (left) treatment.

Combined CO_2 and dye laser technique in the treatment of outcomes due to flap necrosis after surgery for basal cell carcinoma on the nose

Steven Paul Nisticò MD[1] | Luigi Bennardo MD[1] | Mario Sannino MD[2] | Francesca Negosanti MD[3] | Federica Tamburi MD[1] | Ester Del Duca MD[1] | Amerigo Giudice MD[1] | Giovanni Cannarozzo MD[2]

FIGURE 3 Patient n.12 before (left) and after (right) all the procedures

FIGURE 4 Patient n.10 before (left) and after (right) all the procedures



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Idiopathic Scrotal Carcinoma

Journal of Lasers in Medical Sciences

J Lasers Med Sci 2020 Autumn;11(4):x-x

Case Series

http://journals.sbmu.ac.ir/jlms

doi 10.34172/jlms.2020.xx

CO_2 Laser Treatment in Idiopathic Scrotal Calcinosis: A Case Series

Giovanni Cannarozzo[1], Luigi Bennardo[2*], Francesca Negosanti[3], Steven Paul Nisticò[2]

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Background: Idiopathic scrotal calcinosis (ISC) is a benign and uncommon condition characterized by the presence of multiple and calcified nodules of the scrotum without disorders in the calcium/phosphorous metabolism. The condition is usually asymptomatic. Various treatments are available. Surgery is the traditional treatment for ISC, as it allows a histopathological exam. However, newer treatments, such as ablative lasers, have been proposed with very good results.

Methods: In this article, we report our experience in the treatment of ISC with a CO2 laser. Five patients affected by ISC were enrolled for CO2 laser treatment.

Results: All patients had excellent healing. Four patients reported minimal scarring. No bleeding was reported after the procedure. Two patients reported itching and were treated with oral antibiotics and antihistamine drugs.

Conclusion: The CO2 super pulsed laser is a fast and effective way to treat ISC and may be an alternative to traditional surgery in this condition.

Journal of Lasers in Medical Sciences

J Lasers Med Sci 2020 Autumn;11(4):x-x

Case Series

http://journals.sbmu.ac.ir/jlms

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CO_2 Laser Treatment in Idiopathic Scrotal Calcinosis: A Case Series

Giovanni Cannarozzo[1], Luigi Bennardo[2*], Francesca Negosanti[3], Steven Paul Nisticò[2]

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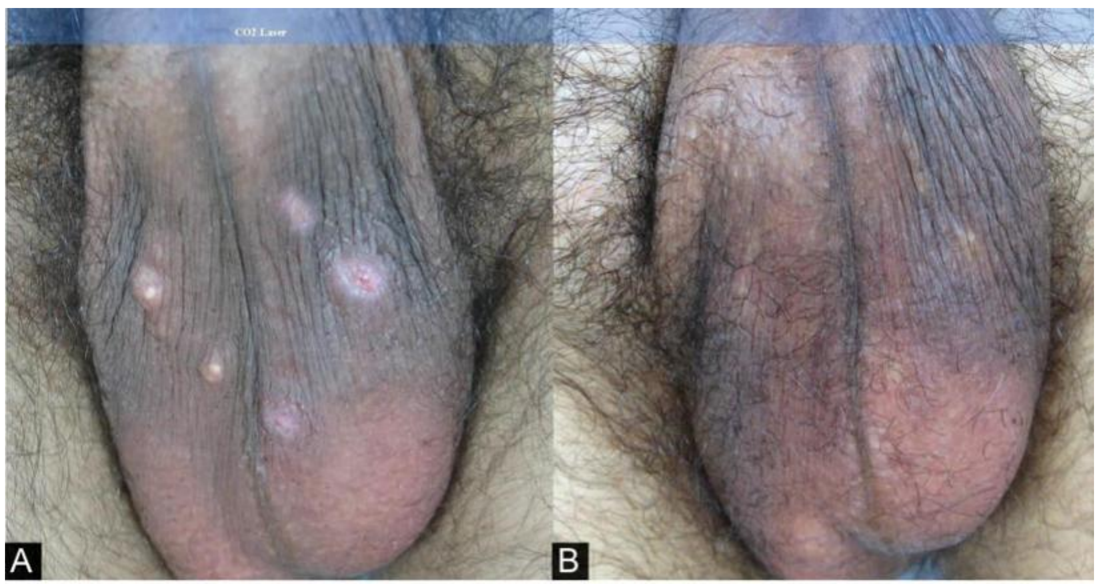
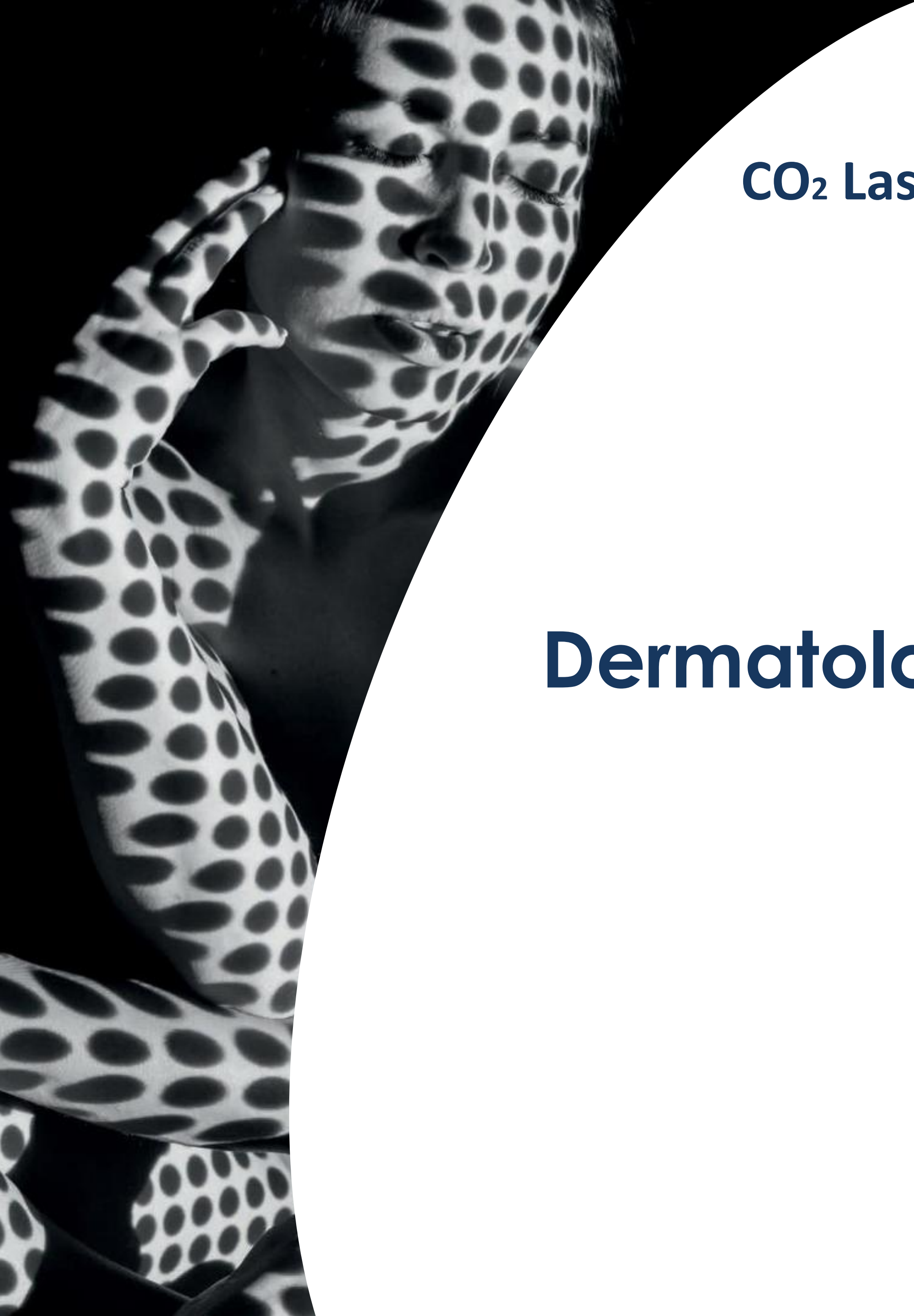


Figure 1. Idiopathic Scrotal Calcinosis Before **(A)** and 10 Years After **(B)** Treatment.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Sebaceous Adenoma

DermaSCAN

ELMER PRESS

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Case Report J Med Cases. 2023;14(7):251-254

Efficacy and Safety of Carbon Dioxide Laser System in the Treatment of Scalp Sebaceous Adenoma With the Use of a New Scanner Unit

Paolo Bonan[a], Giustino Gallo[b], Irene Fusco[b, c], Francesca Madeddu[b], Tiziano Zingoni[b]

Sebaceous adenoma (SA) is a rare solitary tumor that preferentially affects the forehead and scalp. The objective of this case report was to determine the efficacy and safety of a 10,600-nm carbon dioxide (CO2) laser device in the treatment of large scalp SA, using a new scanning system which allows to speed up the removal of the lesion.

A 65-year-old male with SA on the scalp area underwent one session with the CO2 laser system. For this procedure, a new scanner system with 7-inch or 4-inch focal handpieces were used. A local anesthesia with lidocaine was performed before laser treatment. Some possible side effects such as dyschromia, burning sensation, bleeding and mild to moderate post-treatment erythema, itching, crusting, and edema, were checked. In order to monitor the effectiveness of the treatment, clinical photos that documented the patient lesion were captured before treatment and at 1 month of follow-up.

The clinical and aesthetic results observed after laser procedure were excellent, with a complete remission of patient's scalp SA lesion at 4 weeks' follow-up. Patient satisfaction was very high, and no side effects were observed. This laser system technology allows for precise, effective, and targeted action on the lesions treated while simultaneously protecting the surrounding areas, ensuring the best possible re-epithelialization.

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Case Report J Med Cases. 2023;14(7):251-254

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Derma SCAN

Efficacy and Safety of Carbon Dioxide Laser System in the Treatment of Scalp Sebaceous Adenoma With the Use of a New Scanner Unit

Paolo Bonan[a], Giustino Gallo[b], Irene Fusco[b, c], Francesca Madeddu[b], Tiziano Zingoni[b]

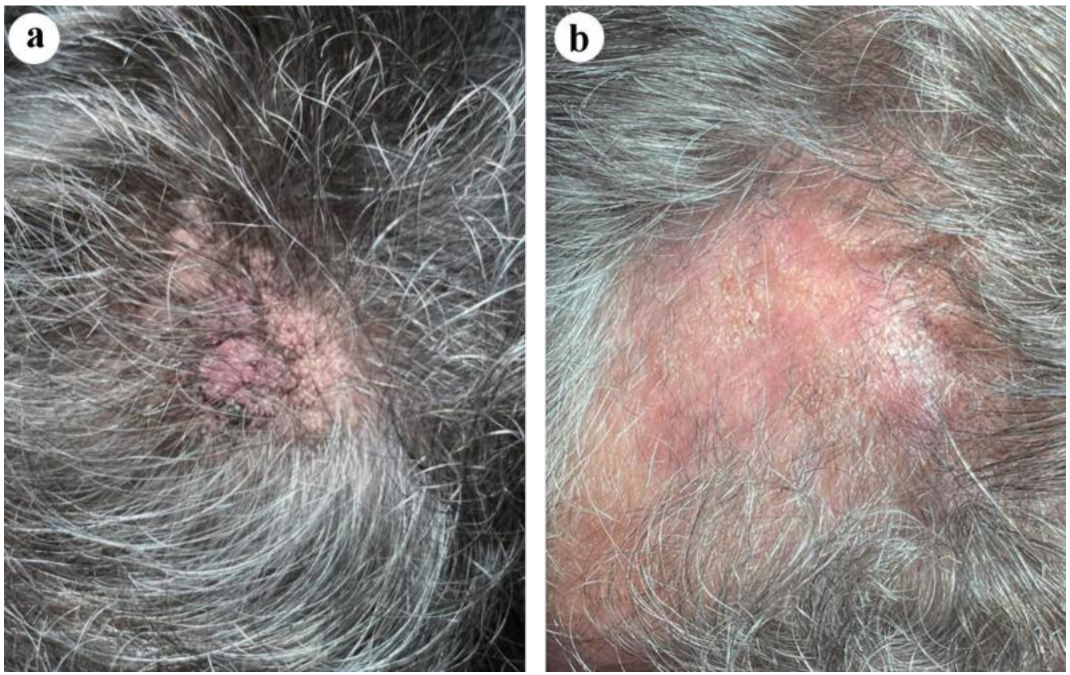


Figure 1. Case presentation of a 65-year-old male patient affected by sebaceous adenoma on the scalp area.
(a) Before treatment.
(b) A complete removal of lesion was observed at 4 weeks' follow-up after the laser treatment session.

For the treatment of SA, patient underwent one session with the CO2 laser system.

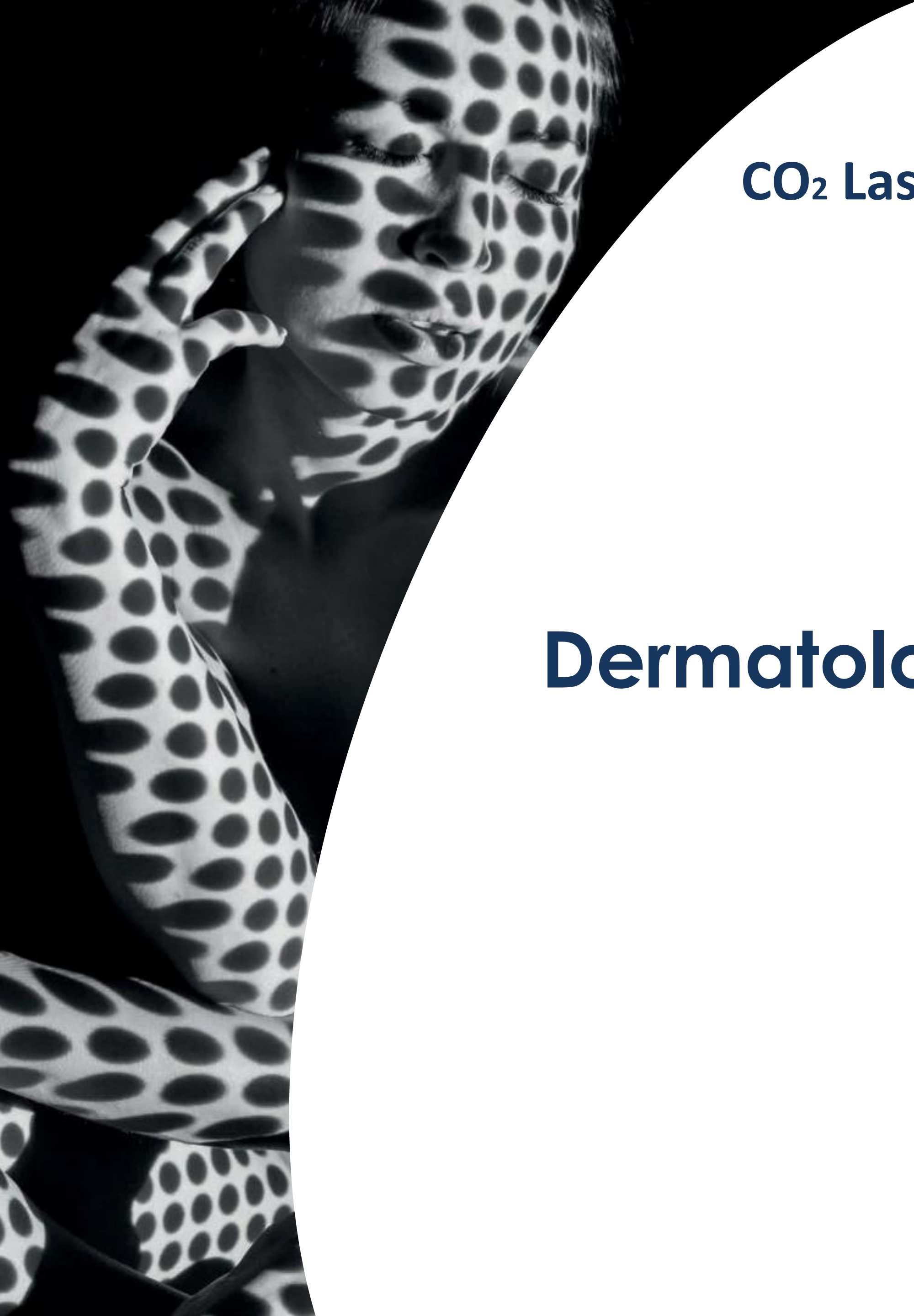
During the initial phase, **Dermascan** with 4-inch focal handpiece was used, and the following parameters were chosen to remove most of the lesion in a short time: power 4 - 10 W, dwell time 0.2 ms, a high-power pulse (UP/HP pulse) and cue ball for the scanning shape.

In the final stages, however, the following parameters were used to refine the lesion: power 0.5 - 1 W, a high-power pulse (UP/HP pulse) and point (no scanning movement) for the shape.

Finally, in order to give homogeneity and uniformity to the tissue, the following parameters were used with the 7-inch focal handpiece: power 8 - 15 W, dwell time 0.2 - 0.3 ms, CW pulse and hexagon for the shape.

Bibliographic Atlas

CO_2 Laser in Dermatological Applications



Dermatological Surgery

Papulosa Nigra

Journal of Cosmetic and Laser Therapy, 2013; Early Online: 1–3

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healthcare

CASE REPORT

Dermatosis Papulosa Nigra and 10,600-nm CO_2 laser, a good choice

NICOLA BRUSCINO[1], ROSSANA CONTI[1], PIERO CAMPOLMI[2], PAOLO BONAN[2], GIOVANNI CANNAROZZO[2], LINDA LAZZERI[1] & SILVIA MORETTI[1]

[1]*Department of Surgery and Translational Medicine, Section of Dermatology, University of Florence, Florence, Italy and* [2]*Department of Dermatology II, University of Florence, Florence, Italy*

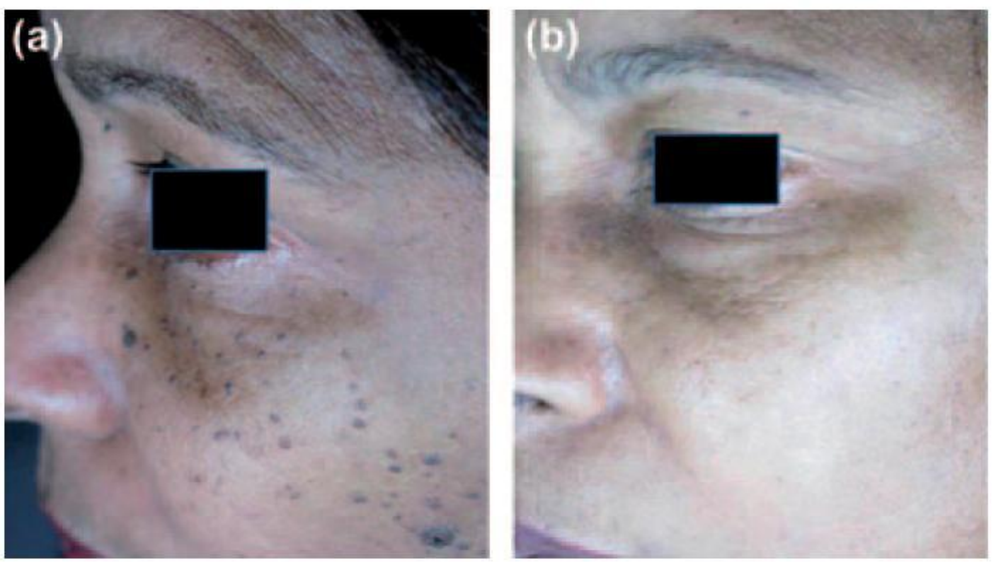

Figure 2. (a) Dermatosis Papulosa Nigra in the Cuban patient at baseline. (b) The same Cuban patient at the 8-month follow-up, no lesion recurrences.

Dermatosis Papulosa Nigra (DPN) is a common skin condition observed in black people and considered a benign epithelial tumor, and more specifically, a particular topographic form of seborrheic keratosis. We treated five female patients affected by DPN with 10600 nm CO2 laser. We propose the 10600 nm CO2 laser as a valid therapeutic option in patients affected by DPN, since the treatmetn is well tolerated, causes no major side effects, and is effective and long lasting.

Journal of Cosmetic and Laser Therapy, 2013; Early Online: 1–3

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CASE REPORT

Dermatosis Papulosa Nigra and 10,600-nm CO_2 laser, a good choice

NICOLA BRUSCINO[1], ROSSANA CONTI[1], PIERO CAMPOLMI[2], PAOLO BONAN[2], GIOVANNI CANNAROZZO[2], LINDA LAZZERI[1] & SILVIA MORETTI[1]

[1]*Department of Surgery and Translational Medicine, Section of Dermatology, University of Florence, Florence, Italy and* [2]*Department of Dermatology II, University of Florence, Florence, Italy*

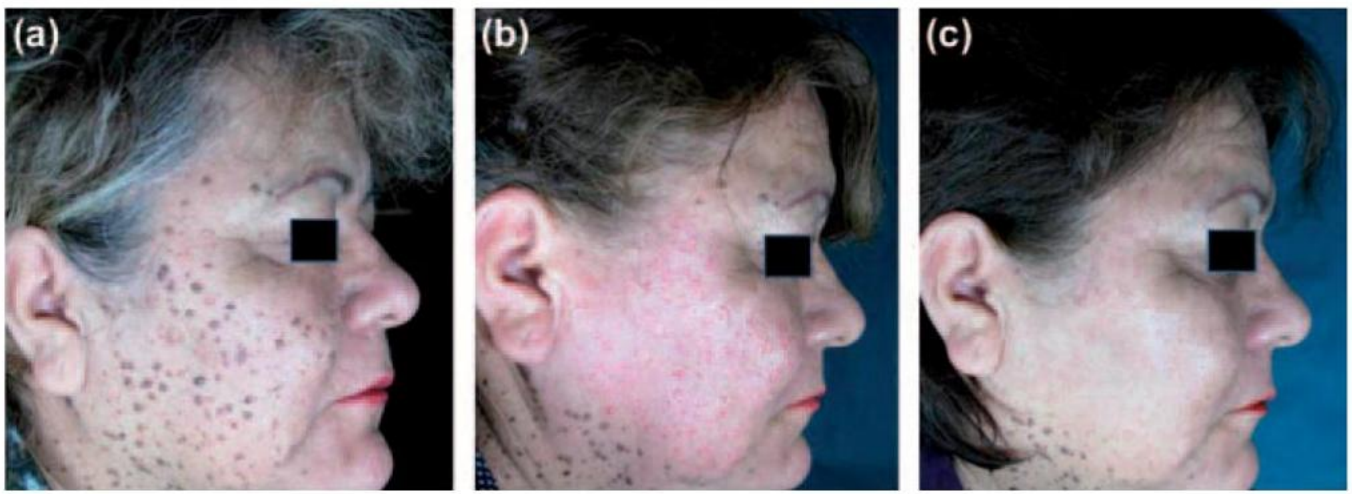
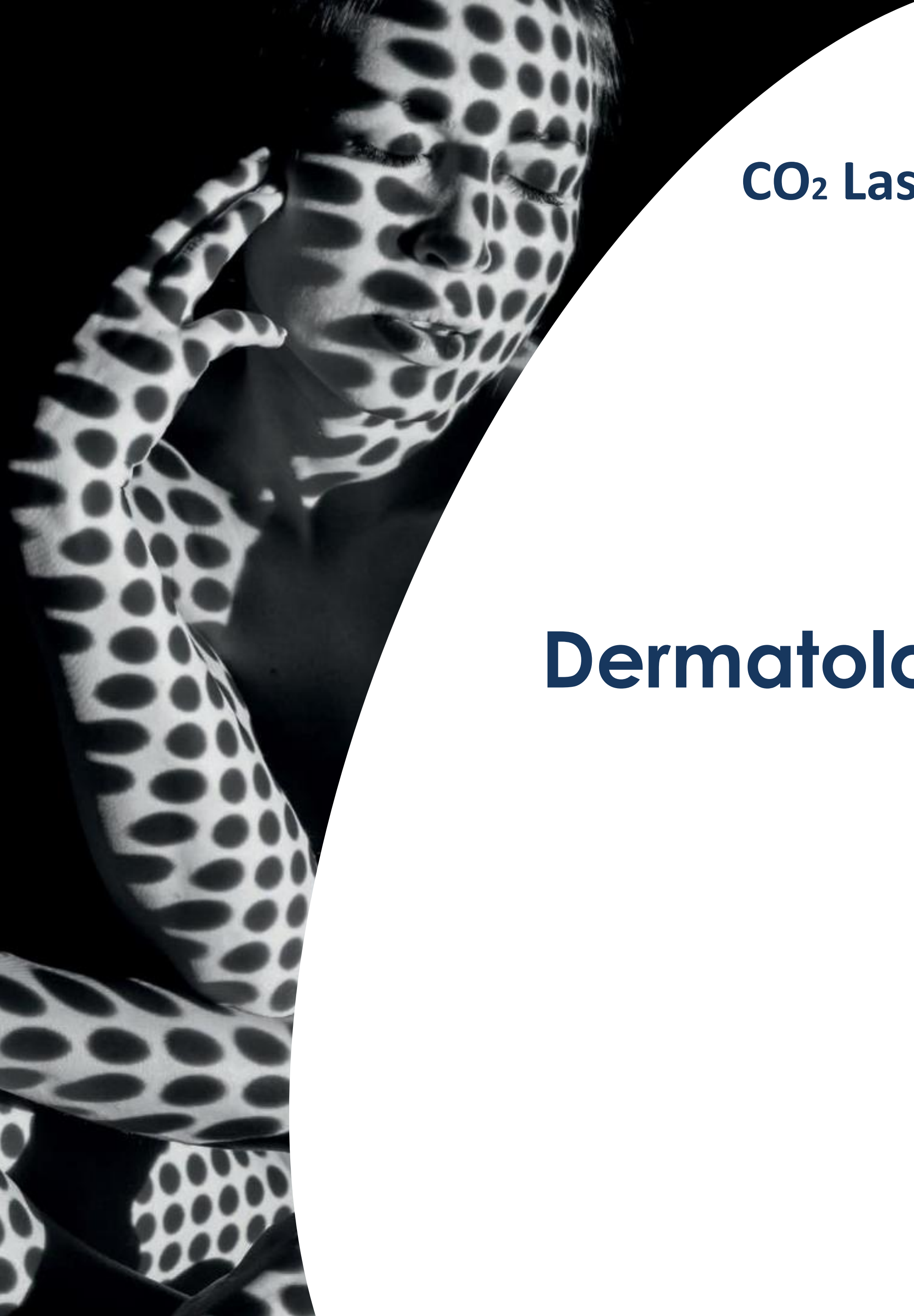


Figure 1. (a) Dermatosis Papulosa Nigra in the Peruvian patient at baseline. (b) Dermatosis Papulosa Nigra in the patient after one treatment with 10,600-nm CO_2 laser. Erythema of the cheek immediately after laser treatment. (c) There are no lesion recurrences and neither side effects at the 8-month follow-up.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Steatocystoma Multiplex

Dermatologic surgery

CO_2 laser therapy in a case of steatocystoma multiplex with prominent nodules on the face and neck

Riccardo Rossi, MD, Pietro Cappugi, MD, MariaLuisa Battini, MD, Luciano Mavilia, MD, and Piero Campolmi MD

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. CO_2 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 CO_2 laser therapy to be an ideal technique for the treatment of steatocystoma multiplex, especially when the lesions are localized in aesthetically important areas.

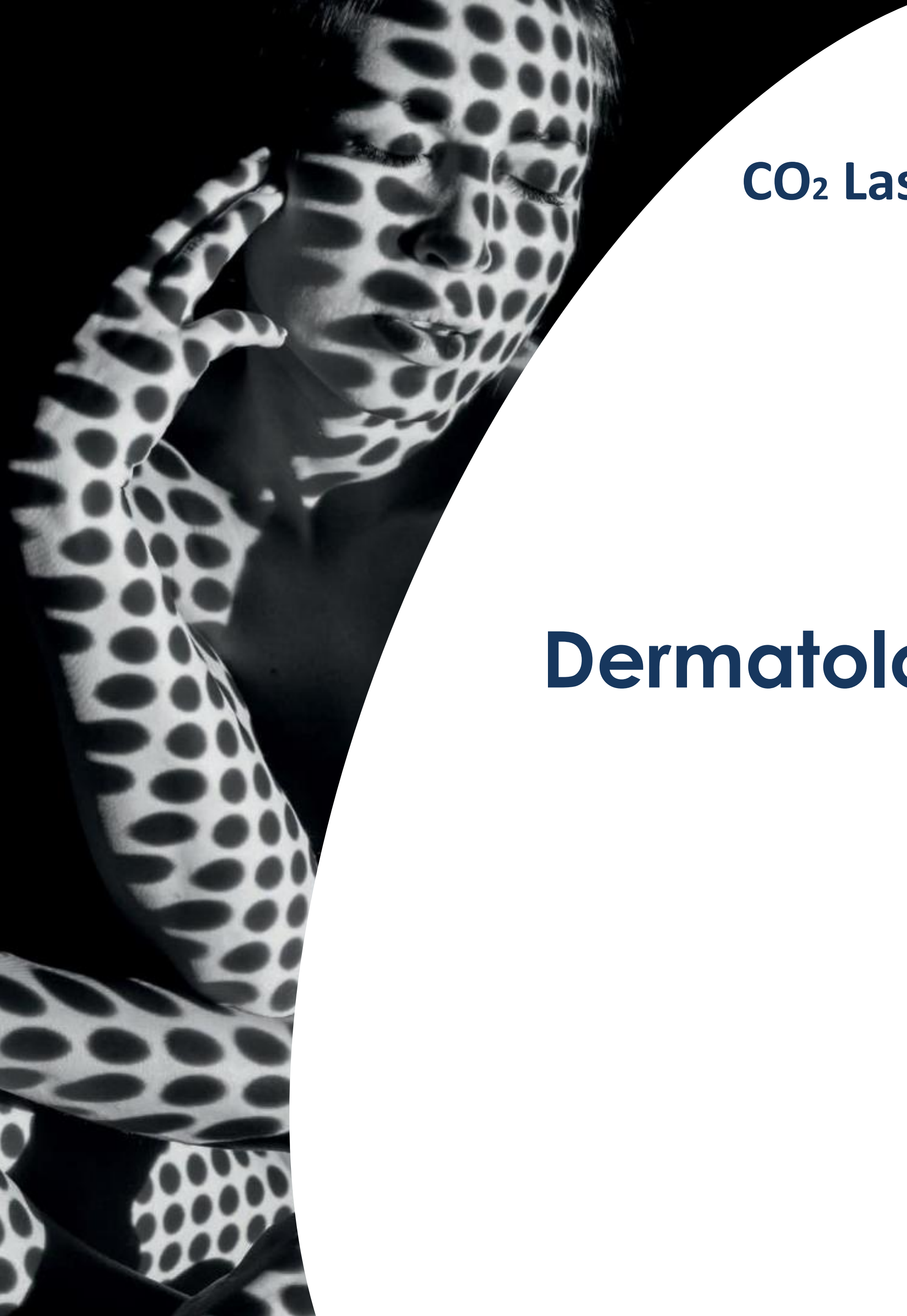
CO_2 laser therapy in a case of steatocystoma multiplex with prominent nodules on the face and neck

Riccardo Rossi, MD, Pietro Cappugi, MD, MariaLuisa Battini, MD, Luciano Mavilia, MD, and Piero Campolmi MD

Figure 1 Nodular cystic lesions of steatocystoma multiplex on the eyelids and forehead

Figure 2 Before CO_2 pulsated laser therapy

Figure 3 Good cosmetic results and no recurrence at 2-year follow-up



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Favre-Racouchot Syndrome

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Treatment of severe Favre-Racouchot Syndrome with carbon dioxide laser

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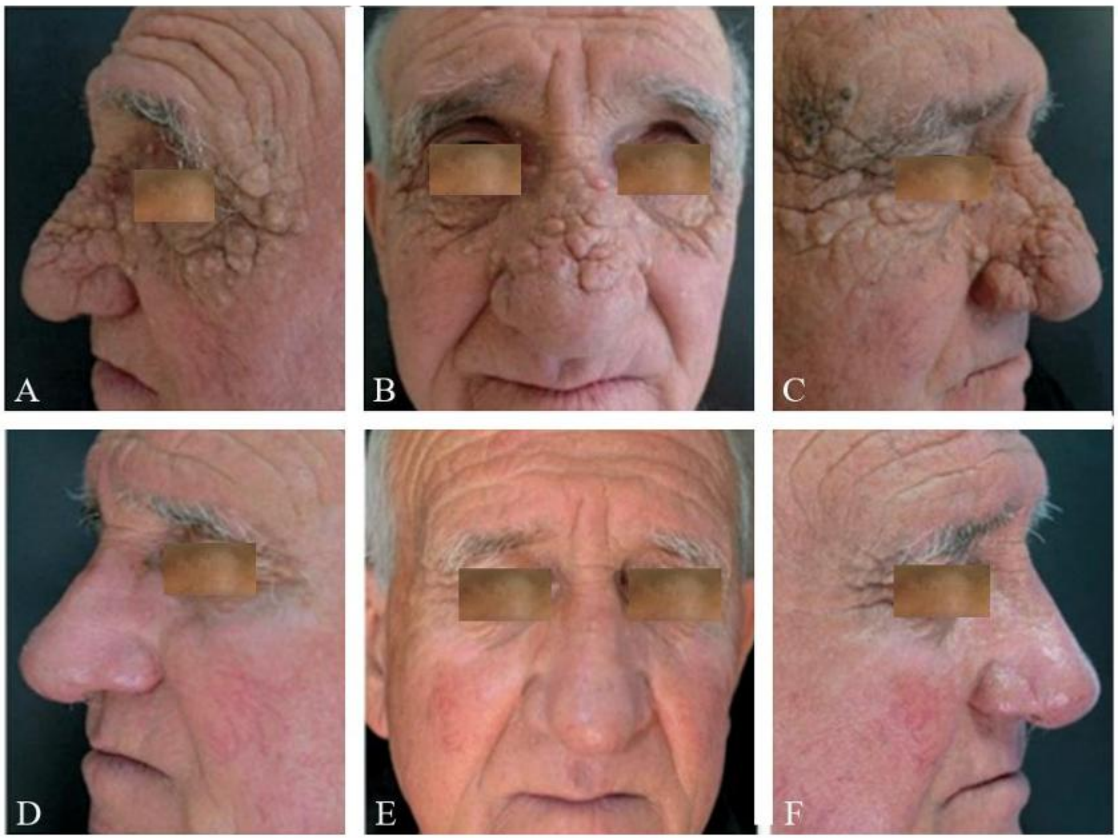
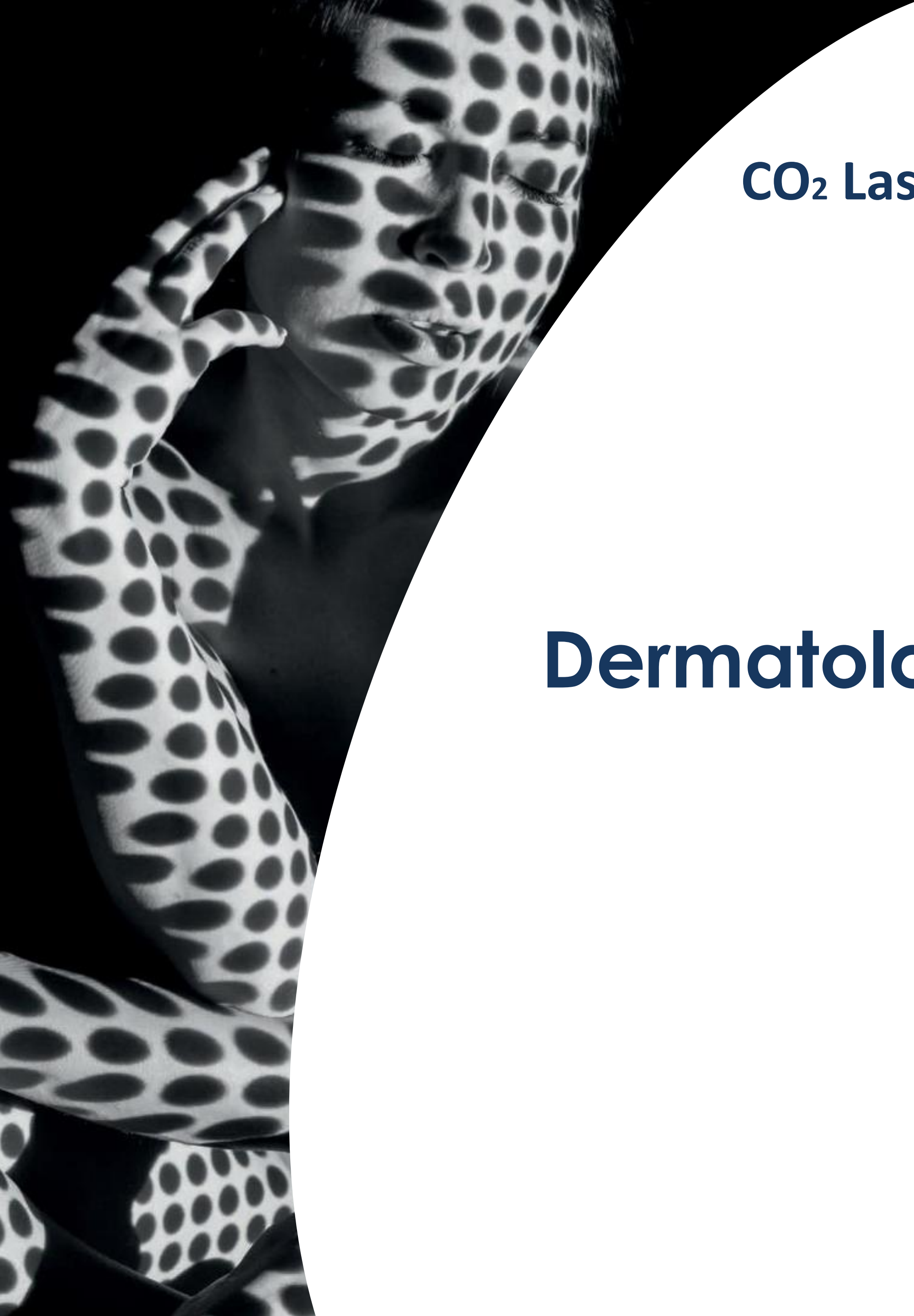


Figure 1. –A-C) Clinical photographs before; and D-F) after 16 months from the treatment.

Preemptive therapy with antiviral (acyclovir 400 mg three times/day) were prescribed starting the day before each treatment for a total of 5 days.
Topical anesthesia with 5% lidocaine cream was applied 40 minutes before treatment with the CO2 laser.

Surgical site was prepared with an antiseptic and eye-shield were applied for patient's safety.
The CO2 laser parameters were: 0.2-1 W and a frequency of 5-10 Hz. During the layer-by-layer vaporization of epidermis, carbonized resulting tissue was removed by a gauze soaked with saline and dried with a clean gauze soon after. Following the unroofing of cysts and comedones, the content was evacuated with forceps. Finally, vaporization of redundant epidermis was performed in layers to obtain a smooth and free of impurites skin.

Home care recommendation included twice daily application of antibiotic cream after strong wound cleansing with gauzes and saline, until complete reepithelization. A second procedure was necessary due to the severity and extension of the condition, even if usually a one-application treatment is enough to reach an optimal result.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Scrotal Verruciform Xantoma

Successful Treatment of Scrotal Verruciform Xanthoma with Shave Debulking and Fractionated Carbon Dioxide Laser Therapy

Figure 1. Pretreatment photograph showing red-yellowish sessile and pedunculated papules on the left scrotal sac.

Figure 4. Post-treatment photograph showing complete resolution of the verruciform xanthoma. lesions with good cosmetic outcome and no recurrence at 18-month follow-up. (Identifying information has been removed for patient confidentiality.)

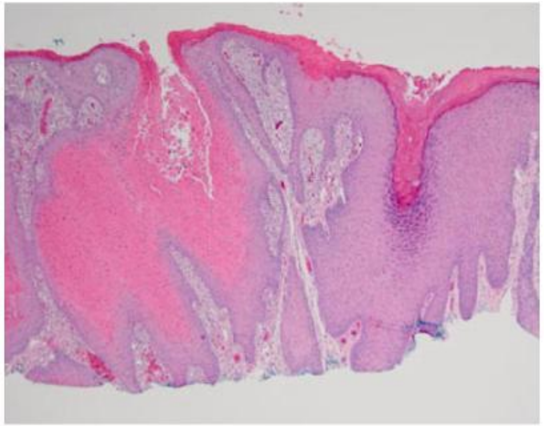


Figure 2. Verrucous acanthosis with parakeratosis (hematoxylin and eosin ×4).

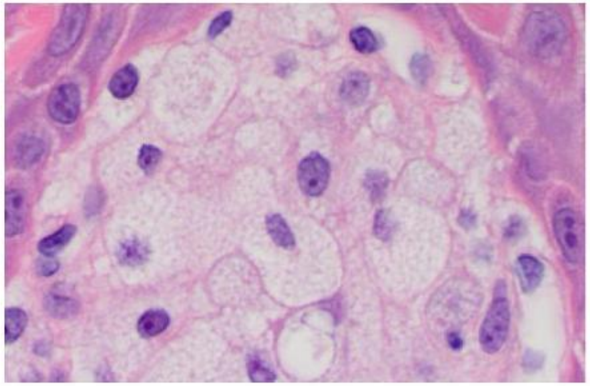
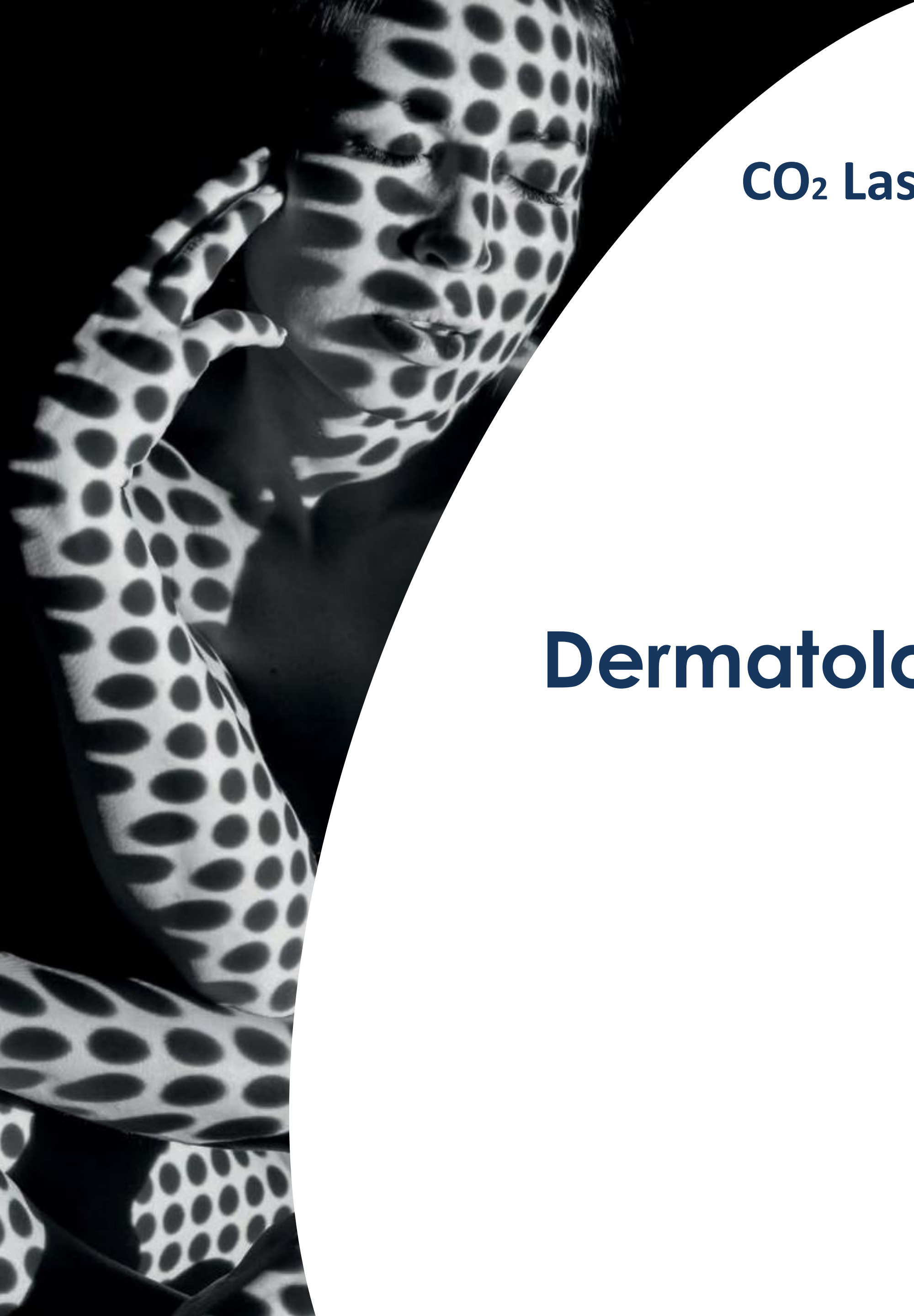


Figure 3. Foamy histiocytes in the papillary dermis, the histopathologic hallmark of verruciform xanthoma (hematoxylin and eosin ×60).



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Dermatofibroma

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CASE REPORT Journal of Drugs in Dermatology

Treatment of a Symptomatic Dermatofibroma With Fractionated Carbon Dioxide Laser and Topical Corticosteroids

Audrey S. Wang MD,[a] Larissa Larsen MD,[a] Shurong Chang MD PhD,[a] Tiffany Phan BA,[a] Jared Jagdeo MD MS[a,b,c]

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Dermatofibromas are benign skin lesions that may be treated if symptomatic or for cosmetic concerns. We present a case of an African American woman with an enlarging, pruritic dermatofibroma on the thigh that was treated with fractionated carbon dioxide (CO2) laser three times approximately 5 weeks apart.
Between laser treatments, topical corticosteroids were applied to the lesion for a total of 13 weeks. The dermatofibroma completely flattened and became asymptomatic within 1 month after the final laser treatment. We hypothesize that the fractionated CO2 laser ablated a portion of the stromal component of the lesion and introduced microscopic channels that facilitated deeper penetration of the topical corticosteroids into the lesion. This is the first reported case demonstrating the successful treatment of a symptomatic dermatofibroma using combination therapy with fractionated CO2 laser and topical corticosteroids.

CASE REPORT

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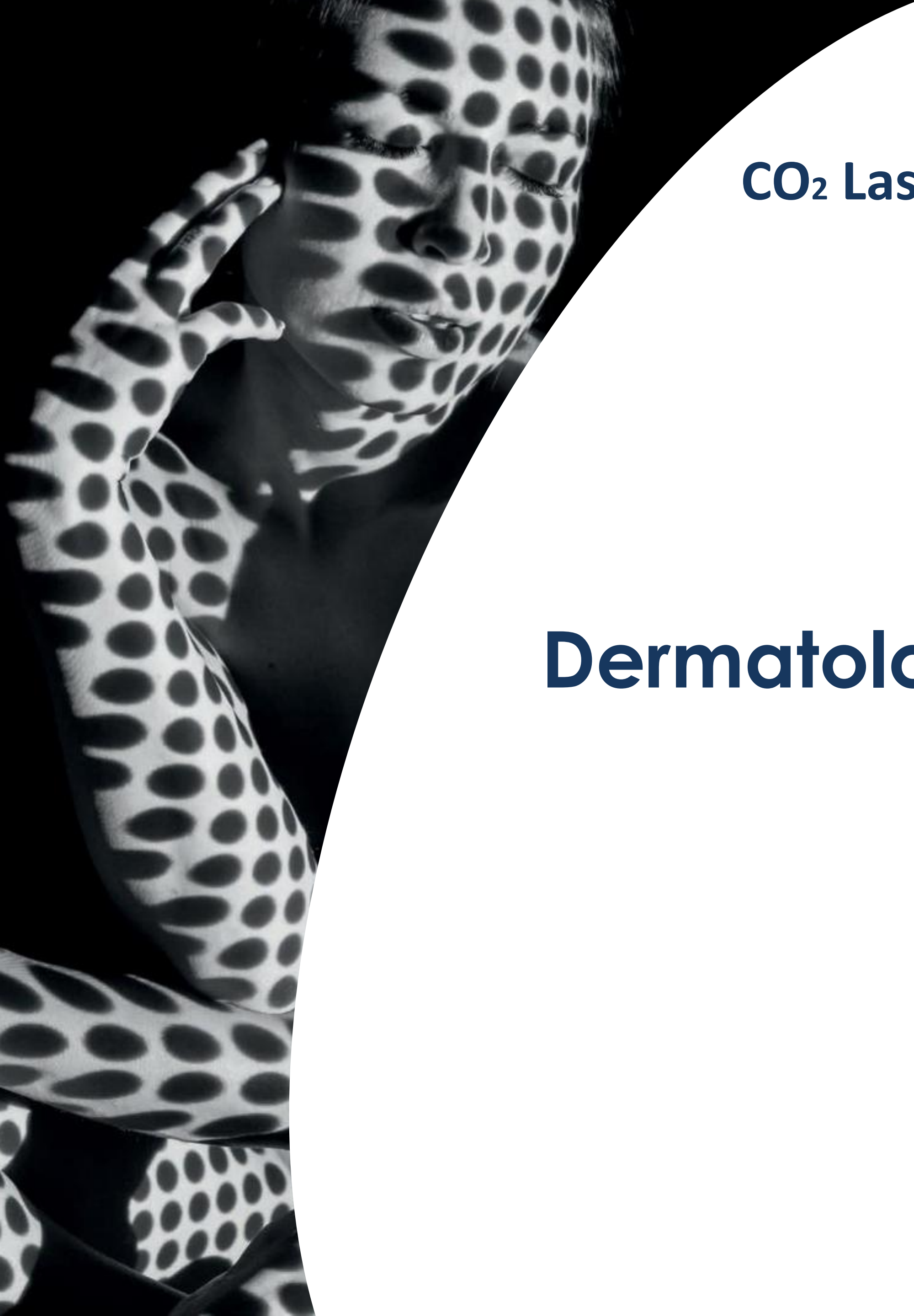
FIGURE 1. Dermatofibroma on the left lateral thigh, pre-treatment.

FIGURE 2. Dermatofibroma on the left lateral thigh, post-treatment. At 7-month follow-up, the lesion is no longer raised, but there is mild peri-lesional hyperpigmentation.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Condylomas

DOI: 10.1111/jdv.12029

ORIGINAL ARTICLE

Efficacy and safety evaluation of an innovative CO_2 laser/radiofrequency device in dermatology

P. Campolmi, P. Bonan, G. Cannarozzo, N. Bruscino,* S. Moretti

Background: CO2 laser has not only become the most widely used laser in dermatological surgical practice, but it has also proved to be highly effective in treating aesthetic imperfections.

Objective: To examine the efficacy and safety of a novel fractional CO2 laser combined with a radiofrequency device in different dermatological, surgical and aesthetic fields.

Methods: A total of 79 patients were treated in our Outpatient Service with a novel fractional CO2 laser combined with a bipolar radiofrequency device for a maximum of 5 months. Group A consisted of 39 patients with lesions requiring complete excision, whereas Group B consisted of 40 subjects seeking to enhance aesthetic facial imperfections. The results were assessed by three 'blind' investigators using photographs and clinical observations; in addition, the patients had to give their own subjective assessment of the results.

Results: At the 6-month follow-up, the lesions of the Group A patients had been completely removed, except for one case of a large sebaceous nevus on the scalp. All the Group B patients showed global improvement in skin tightening, removal of fine lines and rhytides and correction of dilated pores and hyperpigmentation, with no significant side-effects and short downtimes.

Conclusion: This kind of laser meets the needs of the majority of dermatologists requiring a unique, versatile tool to remove cutaneous lesions and at the same time, safely and effectively treat skin imperfections.

DOI: 10.1111/jdv.12029 JEADV

ORIGINAL ARTICLE

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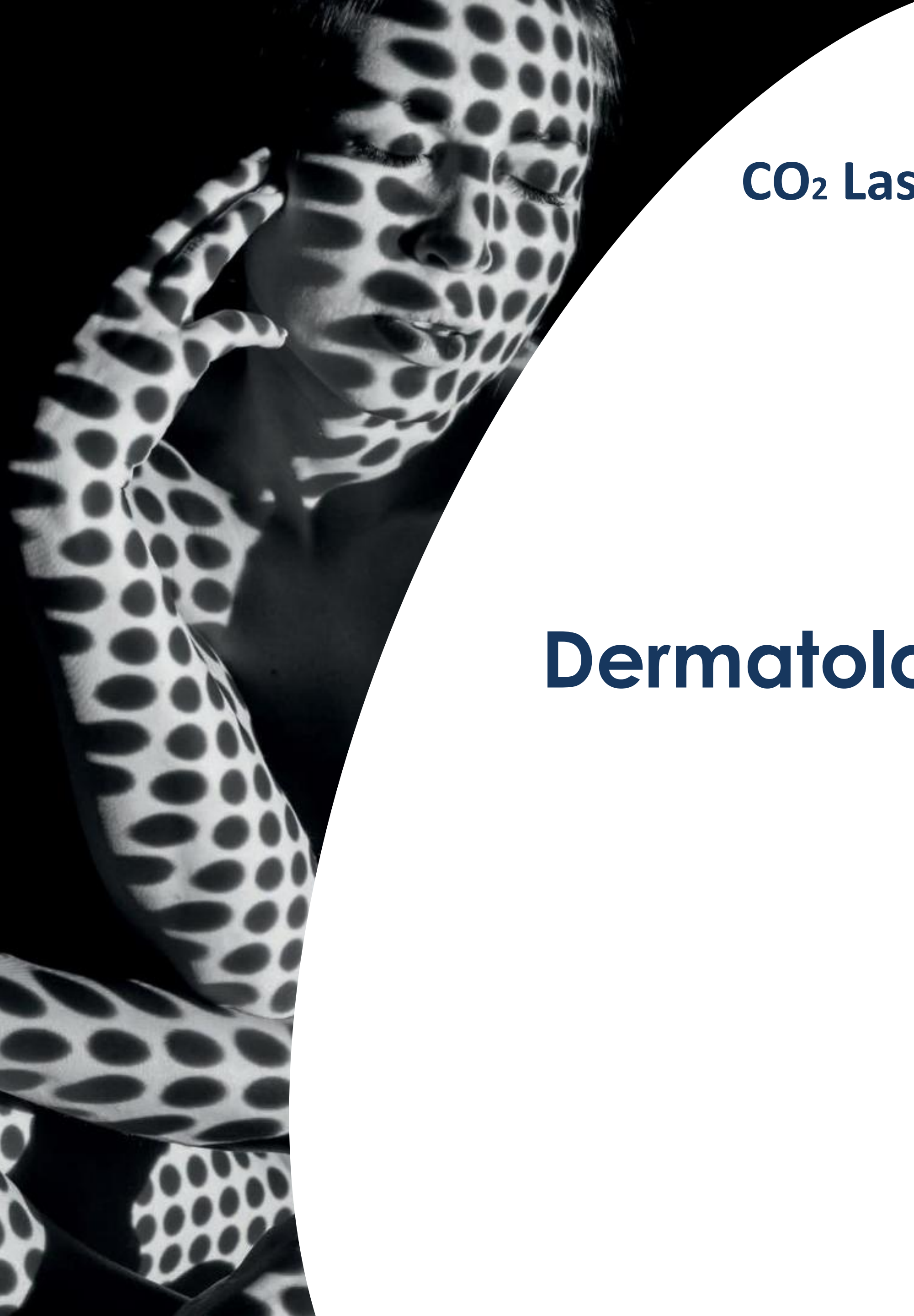
Figure 4 (a) Multiple condylomas of the preputio-glandular area. (b) The same patient as in (a), with no more visible lesions after two lasers sessions and no recurrences at the 6-month follow-up. (c) Multiple perianal acuminate condylomas. (d) The condylomas in (c) were removed after two laser applications with no reappearance of the same lesions at the 6-month follow-up.

The patients were treated for a maximum of 2 months and received from **one to three CO_2 laser applications** at 3-4 week intervals.

They operated with a **power range of 0.1-1W and a frequency of 10Hz**; only occasionally was tha power increased to 2 W and the frequency to 20 Hz for treating the more difficult lesions.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Dermatological Surgery

Iatrogenic Vulvar Lymphangiectasia

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LETTER TO THE EDITOR

Effective use of a combination of surgical ablative and fractional carbon dioxide laser to treat iatrogenic vulval lymphangiectasia—a case study

Florence Robinson[1] · Emma Hitchens[2] · Kay Thomas[2] · Antonio Orlando[2] · Daniel Keith[2]

Received: 24 April 2022 / Accepted: 14 July 2023

Under topical (lidocaine 4% cream, LMX4 Cream, Ferndale Pharmaceuticals Ltd, Leeds, UK) and local anaesthetic (lidocaine 2% with adrenaline, xxylocaine 2% with adrenaline, Aspen, Dublin, Ireland), a 10,600-nm carbon dioxide laser (SmartXide Touch, Deka, Florence, Italy) was used first in fully ablative mode to vapourise the lymphangiectatic vessels (power 0.8–2.0 W; 7” surgical handpiece; Smart Pulse). This was followed by fractional ablation of the field (power 8 W; dwell time 500 µs; spacing 500 µm; stack 2; Smart Scan; Deka Pulse). Yellow soft paraffin (100% yellow soft paraffin, Creightons, UK) was applied post procedure.

The patient reported the area healed within 1 week, and since then the lymphangiectatic vessels had not recurred. There has been resolution of the lymphoedema with no further perceived swelling or discomfort. There has been no recurrence at 18 months post treatment.

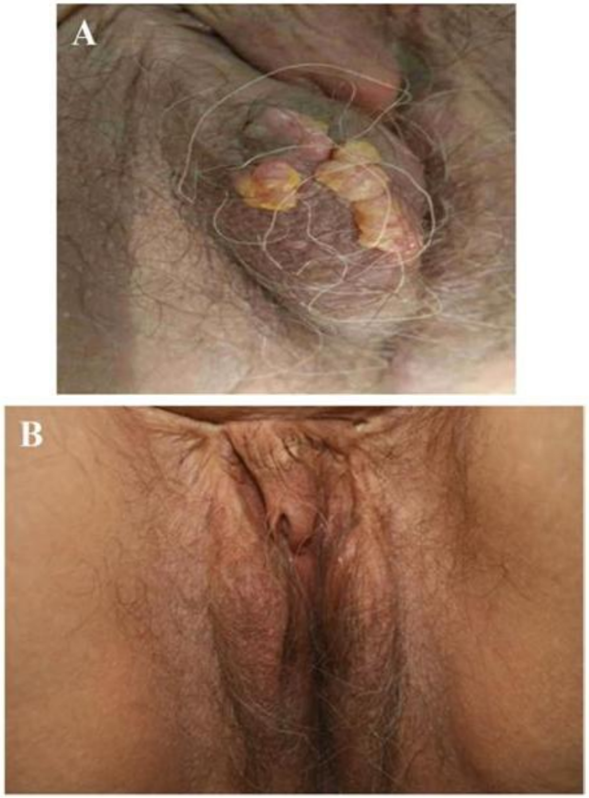


Fig. 1 A) Vulvar lymphangiectasia.
B) Follow-up at 3 months

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Skin Rejuvenation

Pre-Clinical Data

Valutazione in vivo della interazione di un laser CO_2 frazionale sulla cute mediante microscopia confocale

Esperienza personale attraverso l'impiego di parametri conservativi

Elisabetta Sorbellini
Fabio Rinaldi

SUMMARY Evaluation of CO_2 fractional laser effect on the skin by confocal microscopy

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 dermine 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 parameter to potency remain unchanged, and to dermine the spot diameter in skin tissue from the surface to the depth. Our study has demonstrated that smartxide CO2 fractional laser, with the use o 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.

Valutazione in vivo della interazione di un laser CO_2 frazionale sulla cute mediante microscopia confocale

Esperienza personale attraverso l'impiego di parametri conservativi

Elisabetta Sorbellini
Fabio Rinaldi

Figura 3.

*Microscopia confocale del DOT per profondità da 10 a 412 µm.
Parametri: 15 W, 1000 µs, 700 µm, Stack 4. A partire dall'alto, da sinistra a destra: profondità 10 µm, 100 µm, 200 µm, 300 µm, 400 µm*

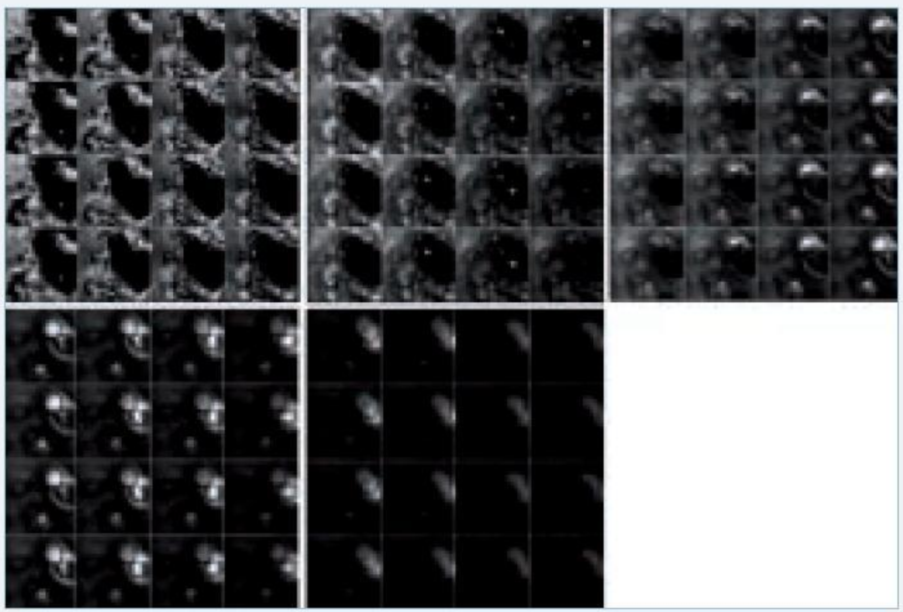


Grafico 1.

A parità di intensità di potenza (13 W) e di durata dell'impulso di 500 µs, variando sia il numero degli Stack che dei passaggi, la profondità aumenta di circa 100 µm (compresa tra ~ 300 e ~ 400 µm).

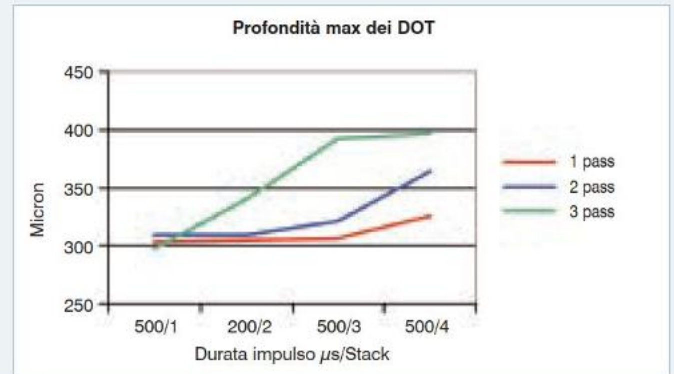
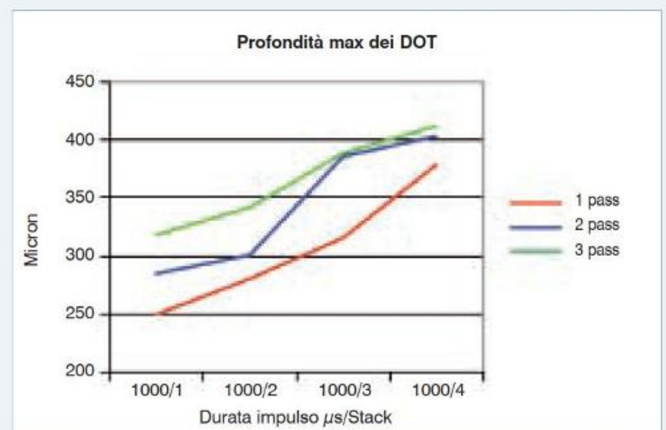


Grafico 2.

A parità di intensità di potenza (13 W) e di durata dell'impulso di 1000 µs, variando sia il numero degli Stack che dei passaggi la profondità massima in ablazione e coagulazione aumenta in analogia al grafico precedente.



Valutazione in vivo della interazione di un laser CO_2 frazionale sulla cute mediante microscopia confocale

Esperienza personale attraverso l'impiego di parametri conservativi

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Figura 7.

*Segni di carbonizzazione ai margini del DOT:
Minimi segni per 13 W, 500 o 1000 µs (A), più evidenti a 20W, 500 µs (B).*

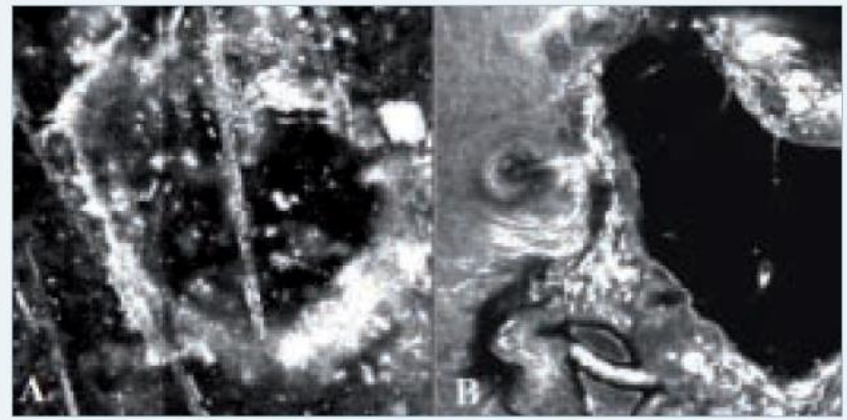
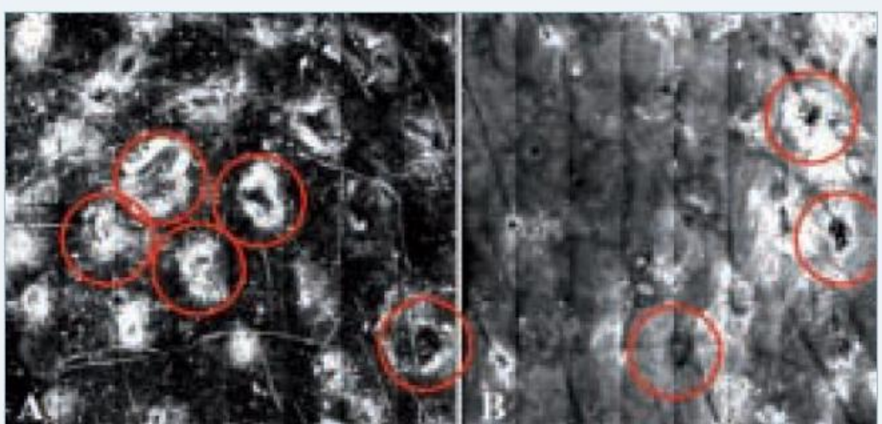


Figura 4.

*Microscopia confocale: profondita di 40 µm (A) e profondita di 280 µm (B).
Parametri: 15W, 500 µs, 700 µm, Stack 4.*



Valutazione in vivo della interazione di un laser CO_2 frazionale sulla cute mediante microscopia confocale

Esperienza personale attraverso l'impiego di parametri conservativi

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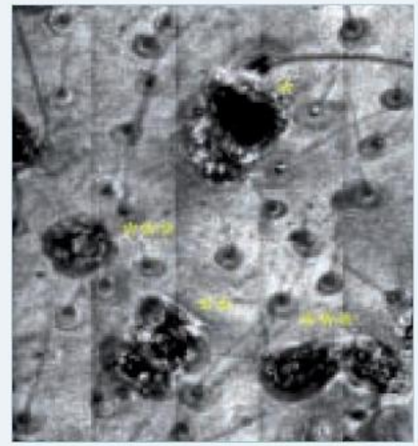


Figura 2.

*Microscopia confocale.
Il diametro medio dello spot all'impatto col corneo risulta di 185 µm ± 20 µm.*

* 195 *µm*
** 208 *µm*
*** 165 *µm*

Figura 5.

*Diametro medio dello spot dalla superficie al derma.
Parametri: 15 W, 500 µs/1000 µs, 700 µm, per Stack impostato a valori 3 e 4.*

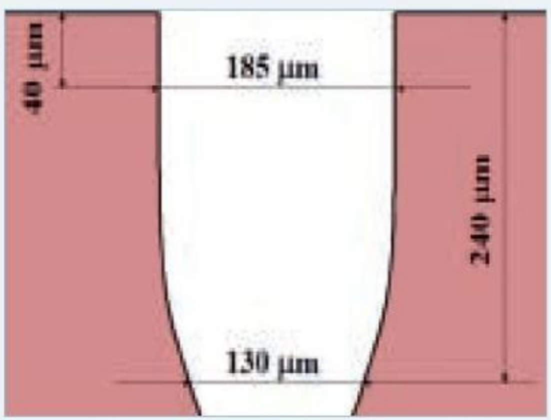
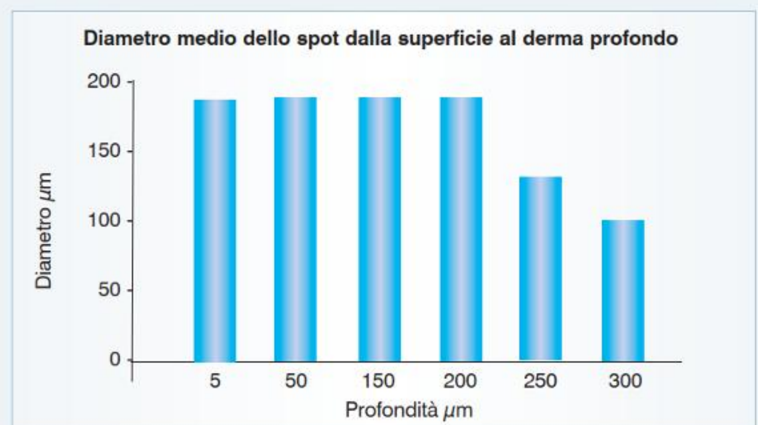


Grafico 3.

*Parametri: 15 W, 500 µs/1000 µs, 700 µm, per Stack impostato a valori 3 e 4.
Oltre i 300 µm non è possibile determinare l'esatto diametro per la perdita di definizione.*



In-vivo multiphoton imaging of collagen remodeling after micro-ablative fractional rejuvenation

Riccardo Cicchi*[,a], Dimitrios Kapsokalyvas[a], Michela Troiano[b], Piero Campolmi[b], Cristiano Morini[b], Alessandro Cosci , Daniela Massi[c], Torello Lotti[b], and Francesco S. Pavone[a]

[a]European Laboratory for Non-linear Spectroscopy (LENS), University of Florence, 1 Via Nello Carrara, 50019 Sesto Fiorentino, Italy
[b]Interuniversitary Center for Biological and Psychosomatic Dermatology (CIDEBIP) and Department of Dermatological Science, University of Florence, Florence, Italy;
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The potential of multiphoton microscopy in providing in-vivo early diagnosis of skin lesions has already been demonstrated, while its capability in therapy follow-up has not been deeply explored so far. Two-photon excited fluorescence and second-harmonic generation microscopy were used in combination to follow-up collagen remodeling after laser micro-ablative rejuvenation. Treated regions of volunteers were imaged with multiphoton microscopy before and after treatment, and we found a strong age-dependence of the treatment effectiveness. In particular, the photo-rejuvenating effect was negligible in young subjects (< 30 years), whereas a significant production of new collagen was observed in aged subjects (> 70 years). Quantification of the amount of newly produced collagen and its organization were performed by means of visual examination of two-photon images. The obtained results demonstrate the performance of laser fractional micro-ablative rejuvenation without the need of an invasive biopsy as well as the wide applicability range of applications for multiphoton microscopy in clinical dermatology.

In-vivo multiphoton imaging of collagen remodeling after micro-ablative fractional rejuvenation

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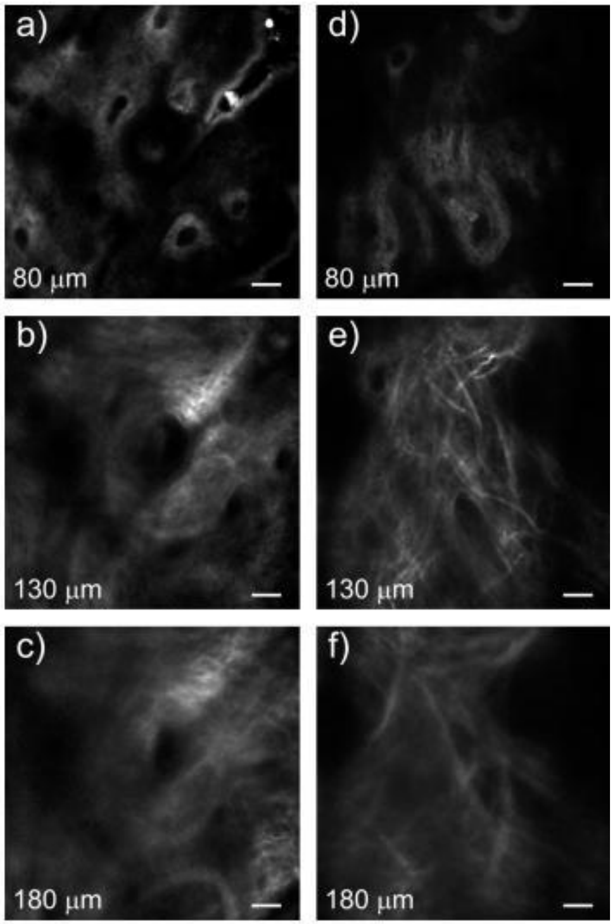

Figure 1. In-vivo two-photon images of human dermis acquired at 80 µm, 130 µm and 180 µm on the outer forearm on health volunteers (Group I) before and after laser fractional rejuvenation treatment. Representative images of the Group I (**age <35 years**) taken before (1,b,c) and 40 days after the treatment (d,e,d). Scale bars: 10 µm

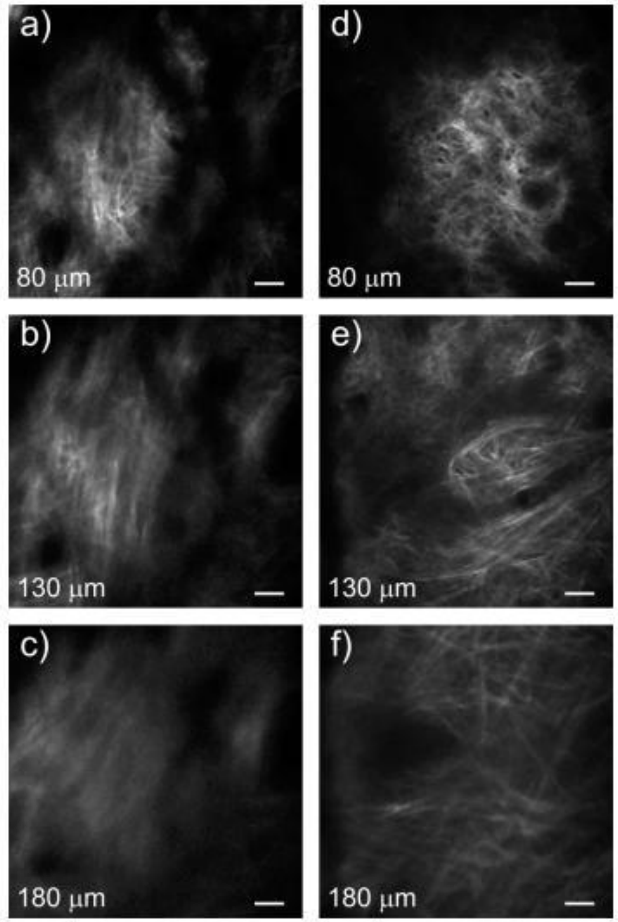

Figure 2. In-vivo two-photon images of human dermis acquired at 80 µm, 130 µm, and 180 µm depth on the outer forearm of healthy volunteers (Group II) before and after laser fractional rejeuvenation treatment. Representative images of the Group II (**35 years < age < 60 years**) taken before (a,b,c) and 40 days after the treatment (d,e,f). Scale bars: 10 µm.

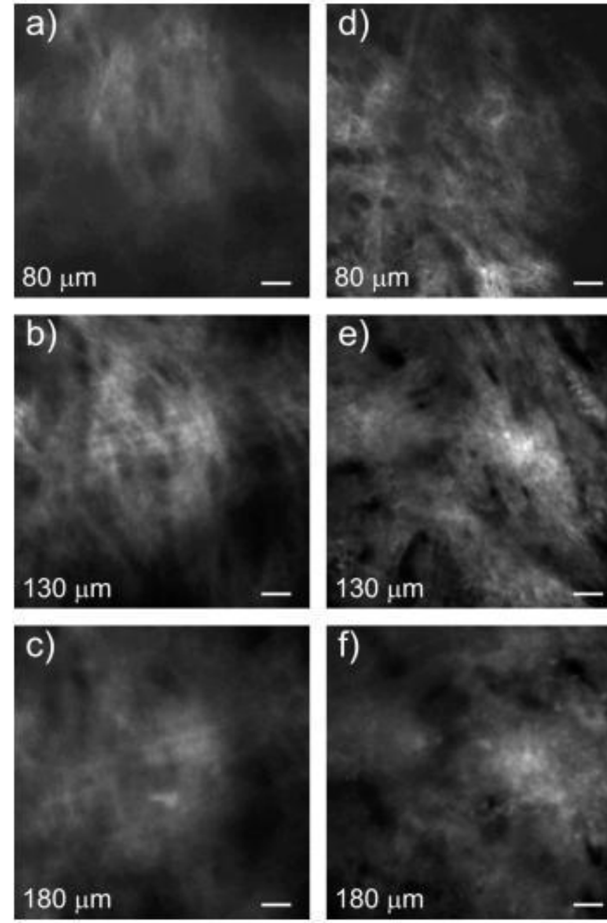

Figure 3. In-vivo two-photon images of human dermis acquired at 80 µm, 130 µm, and 180 µm depth on the outer forearm of healthy volunteers (Group III) before and after laser fractional rejeuvenation treatment. Representative images of the Group III (**age > 60 years**) taken before (a,b,c) and 40 days after the treatment (d,e,f). Scale bars: 10 µm.

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DERMATOLOGIC THERAPY
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Fractional CO_2 laser: a novel therapeutic device upon photobiomodulation of tissue remodeling and cytokine pathway of tissue repair

F. Prignano, P. Campolmi, P. Bonan, F. Ricceri, G. Cannarozzo, M. Troiano & T. Lotti
Department of Dermatological Sciences, Florence University, Florence, Italy

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 CO(2) 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.

Table 1. Cytokines involved in wound-healing processes and their major function

Cytokines	Major function
TGF-β	• Stimulates matrix proteins (such as collagen), inhibits protease production, and enhances mitogenesis. • Activates the chemotaxis of macrophages and granulocytes, and releases proinflammatory cytokines: interleukin-1, interleukin-6, and tumor necrosis factor-α.
bFGF	• Angiogenetic and mitogenic activity. • Provides the initial stimulation of endothelial cell migration and proliferation. • Inhibits collagen production and promotes organized collagen bundles.
EGF	• Re-epithelization activity (i.e., keratinocyte proliferation, keratinocyte marginalization, hyperproliferative wound epidermis, etc.).
PDGF	• Chemotactic activity for monocytes, macrophages, and neutrophils. • Mitogenic activity for fibroblasts and smooth muscle cells in vitro. • Stimulates fibroblasts to produce extracellular matrix and to contract collagen matrix.
VEGF	• Regulates vasculogenesis and angiogenesis.
Vimentin	• Fibroblast protein: involved in matrix and intercellular substance production.

bFGF, basic fibroblast growth factor; EGF, endothelial growth factor; PDGF, platelet-derived growth factor; TGF-β, transforming growth factor-β; VEGF, vascular endothelial growth factor.

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DERMATOLOGIC THERAPY
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Growth factor and cytokines (mainly those of tissue repair) play a multiple and specific role in skin-repairing processes …

…The application of different laser fluences in the present study resulted in a change in growth factor profiles…

Table 3. Results of immunolabeling scores at time 0, immediately after treatment, 3 days after treatment, and 30 days after treatment thereafter with 2.07, 2.77, and 4.15 J/cm^2 irradiation

		Immediately after			3 days after			30 days after		
	Time 0	2.07 J/cm^2	2.77 J/cm^2	4.15 J/cm^2	2.07 J/cm^2	2.77 J/cm^2	4.15 J/cm^2	2.07 J/cm^2	2.77 J/cm^2	4.15 J/cm^2
EGF	1	3	2	0	3	1	0	1	3	0
bFGF	0	1	0	1	1	2	1	1	3	0
PDGF	1	2	1	1	2	2	2	1	2	0
VEGF	0	1	1	0	1	1	0	1	1	0
TGF-β	0	1	0	0	2	3	0	1	1	0
Vimentin	1	3	0	0	3	2	0	1	1	0

EGF, bFGF, PDGF, VEGF, TGF-β, and vimentin immunoreactive cells were observed under light microscopy. A range from 0 to 3 was used for the score. The absence of immune reaction was scored as "0," a scarce immunoreactivity was scored as "1," an intermediate immunoreactivity was scored as "2," and an intense immunoreactivity was scored as "3."

bFGF, basic fibroblast growth factor; EGF, endothelial growth factor; PDGF, platelet-derived growth factor; TGF-β, transforming growth factor-β; VEGF, vascular endothelial growth factor.

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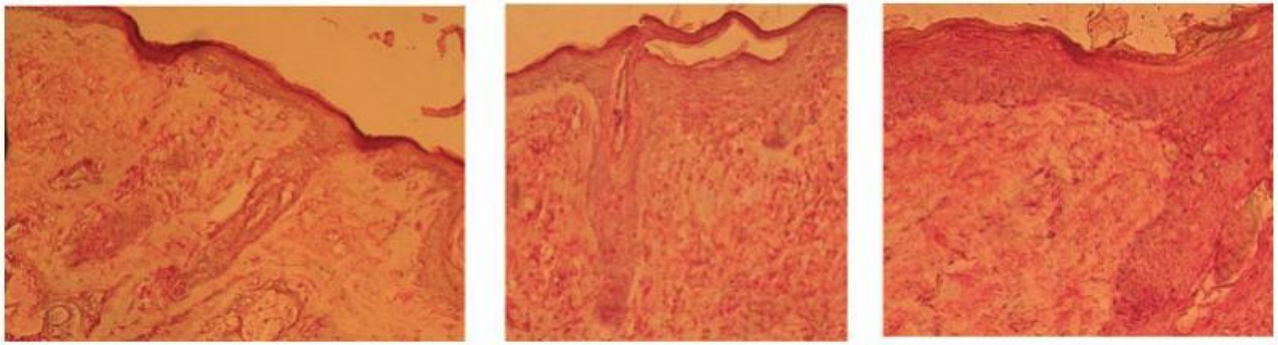
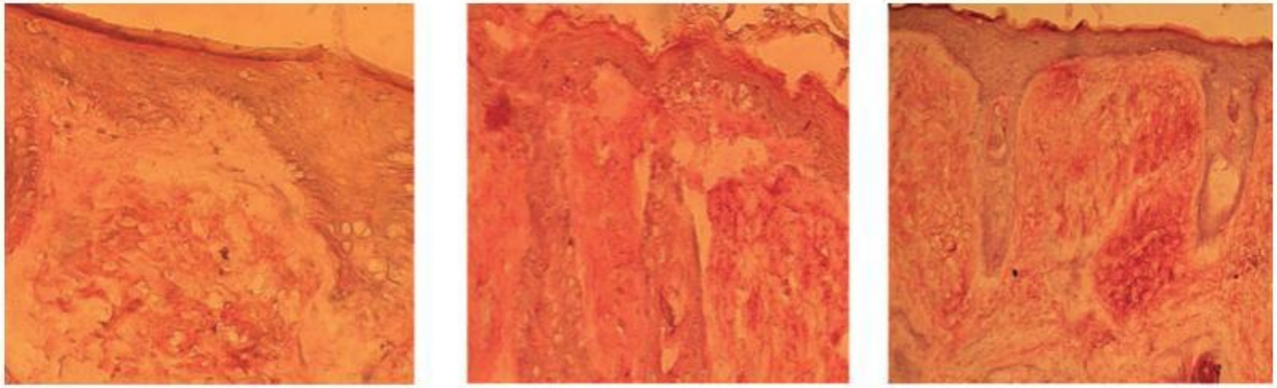


(A) (B) (C)

FIG. 3. **Immunohistochemistry (alkaline phosphatase-anti-alkaline phosphatase): (A) Time 0 (control): endothelial growth factor (EGF) is expressed within the epidermal layers and in part of the dermis (magnification ×150). (B) Immediately after laser treatment at 2.07 J/cm²: intense staining for EGF within the epidermis and in the dermis (magnification ×150). (C) Three days after laser treatment at 2.07 J/cm²: intense staining for EGF within the epidermis and the dermis with a complete re-epithelization (magnification ×150).**



(A) (B) (C)

FIG. 4. **Immunohistochemistry (alkaline phosphatase-anti-alkaline phosphatase): (A) Time 0 (control): platelet-derived growth factor (PDGF) is moderately expressed in the epidermis and in the dermis (magnification ×150). (B) Immediately after laser treatment at 2.77 J/cm²: positive staining for PDGF but with higher intensity within the dermis closer to the columns of laser disruption (magnification ×250). (C) Three days after laser treatment at 2.77 J/cm²: absence of PDGF expression within the epidermis, and moderate expression within the dermis (magnification ×150).**

Table 1. Cytokines involved in wound-healing processes and their major function

Cytokines	Major function
TGF-β	• Stimulates matrix proteins (such as collagen), inhibits protease production, and enhances mitogenesis. • Activates the chemotaxis of macrophages and granulocytes, and releases proinflammatory cytokines: interleukin-1, interleukin-6, and tumor necrosis factor-α.
bFGF	• Angiogenetic and mitogenic activity. • Provides the initial stimulation of endothelial cell migration and proliferation. • Inhibits collagen production and promotes organized collagen bundles.
EGF	• Re-epithelization activity (i.e., keratinocyte proliferation, keratinocyte marginalization, hyperproliferative wound epidermis, etc.).
PDGF	• Chemotactic activity for monocytes, macrophages, and neutrophils. • Mitogenic activity for fibroblasts and smooth muscle cells in vitro. • Stimulates fibroblasts to produce extracellular matrix and to contract collagen matrix.
VEGF	• Regulates vasculogenesis and angiogenesis.
Vimentin	• Fibroblast protein: involved in matrix and intercellular substance production.

bFGF, basic fibroblast growth factor; EGF, endothelial growth factor; PDGF, platelet-derived growth factor; TGF-β, transforming growth factor-β; VEGF, vascular endothelial growth factor.

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Fractional CO_2 laser: a novel therapeutic device upon photobiomodulation of tissue remodeling and cytokine pathway of tissue repair

F. Prignano, P. Campolmi, P. Bonan, F. Ricceri, G. Cannarozzo, M. Troiano & T. Lotti
Department of Dermatological Sciences, Florence University, Florence, Italy

In conclusion,n the results of the present study demonstrate that a multitude of growth factors and cytokines are present at the wound site. After skin irradiation, the dynamics of these vary over time, and the quality and the sequential secretion of these citokines are extremely important for achieving good quality wound repair.

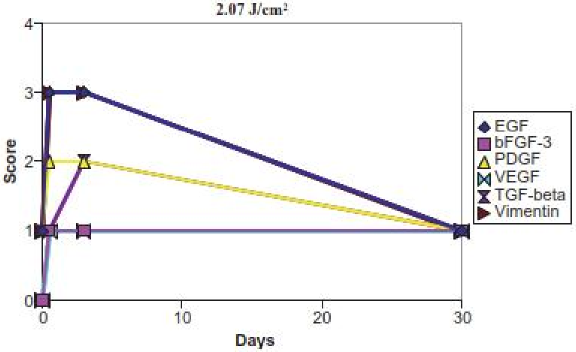

FIG. 5. The graph shows the results of immunolabeling scores at time 0, immediately after treatment, 3 days after treatment, and 30 days after treatment with 2.07 J/cm². bFGF, basic fibroblast growth factor; EGF, endothelial growth factor; PDGF, platelet-derived growth factor; TGF-beta, transforming growth factor-β; VEGF, vascular endothelial growth factor.

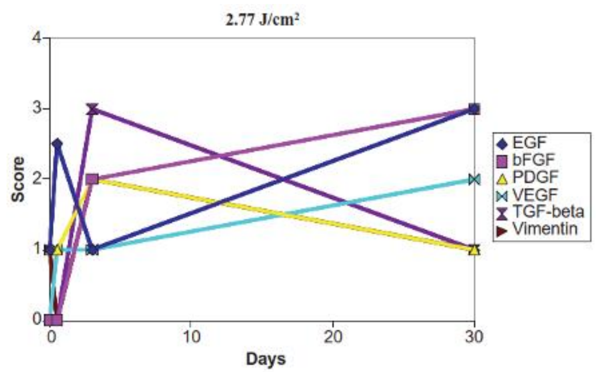

FIG. 6. The graph shows the results of immunolabeling scores at time 0, immediately after treatment, 3 days after treatment, and 30 days after treatment with 2.77 J/cm². bFGF, basic fibroblast growth factor; EGF, endothelial growth factor; PDGF, platelet-derived growth factor; TGF-beta, transforming growth factor-β; VEGF, vascular endothelial growth factor.

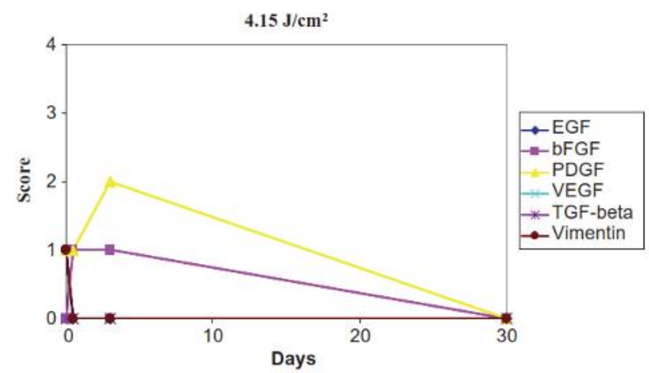

FIG. 7. The graph shows the results of immunolabeling scores at time 0, immediately after treatment, 3 days after treatment, and 30 days after treatment with 4.15 J/cm². bFGF, basic fibroblast growth factor; EGF, endothelial growth factor; PDGF, platelet-derived growth factor; TGF-beta, transforming growth factor-β; VEGF, vascular endothelial growth factor.

Original Contribution

A study of fractional CO_2 laser resurfacing: the best fluences through a clinical, histological, and ultrastructural evaluation

Francesca Prignano, MD, PhD, Diletta Bonciani, MD, Piero Campolmi, MD, Giovanni Cannarozzo, MD, Paolo Bonan, MD, & Torello Lotti, MD

Departement of Dermatological Sciences, Florence University, Florence, Italy

Background: Fractional resurfacing is a laser treatment modality to create numerous microscopic thermal injury zones of controlled width, depth and density that are surronded 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 or III with with photodamage skin underwent fradtional laser treatment with one single-pass superficial on the face and forearm. Clinical Outcome and histological and ulstra structural changes were assessed.

Results: Light microscopy of biopsies gave important information about skin changes at three different times after fractional treatment, especially revealling 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 4.15J/cm2, it is possible to reach a biological response without scar formation.

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2.07 J/cm2

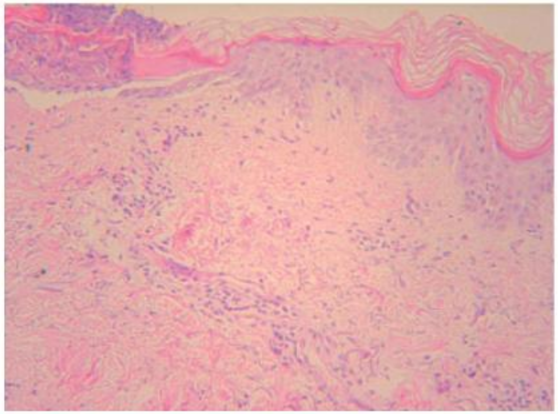

Figure 1 Optical microscopy. Twenty-four hours after 2.07 J/cm^2 laser irradiation. Increase of epidermal–dermal distance in the superficial dermis. Mainly close to the irradiating source. Ematossilin-eosin (EE) ×150.

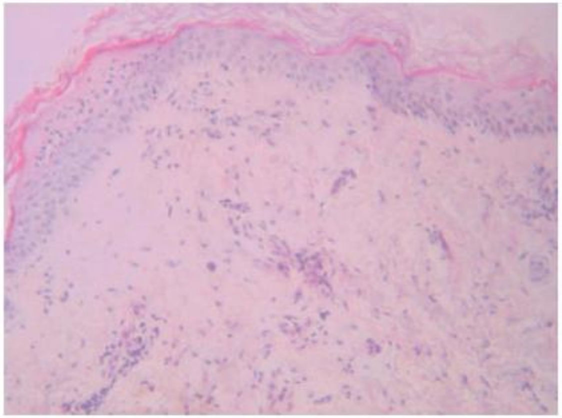

Figure 2 Optical microscopy. Three days after 2.07 J/cm^2 laser irradiation. Cells of medium size in the superficial, medium, and deep dermis. EE, ×150.

2.77 J/cm2

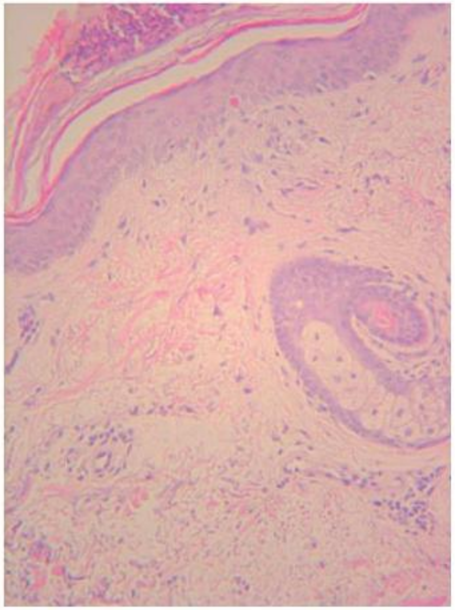

Figure 3 Optical microscopy. Three days after 2.77 J/cm^2 laser irradiation. Cells resembling "sunburn cells" among basal cells. Infiltrating cells, some in groups and some scattered within all the dermis. EE, ×150.

4.15 J/cm2

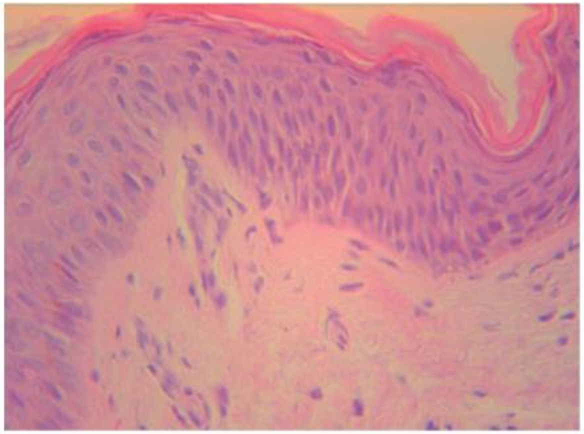

Figure 4 Optical microscopy. Seven days after 4.15 J/cm^2 laser irradiation. Cells resembling "sunburn cells" among basal keratinocytes and spindle-shape cells immediately below the plasma membrane and in the dermis. EE ×300.

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Departement of Dermatological Sciences, Florence University, Florence, Italy

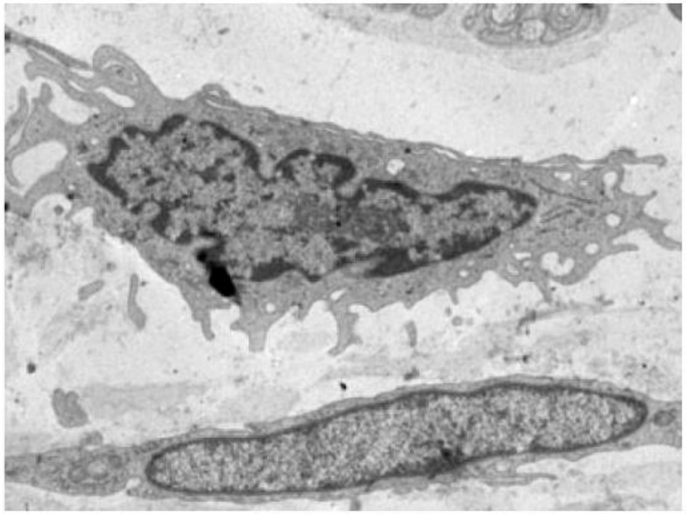

Figure 5 Electron microscopy. Two fibroblasts of the dermis. The first is active (arrow) with a large indented hyperchromatic nucleous and a second, resting one, with the typical elongated shape, and no organelles within the cytoplasm ×8000.

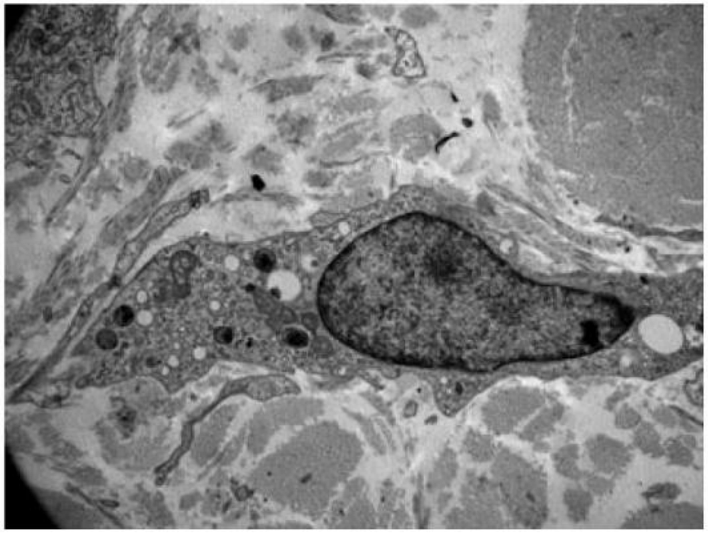

Figure 6 Electron microscopy. A resting fibroblast, with many lysosomes within the cytoplasm. Many collagen fibers around the fibroblast (arrow) ×8000.

A study of fractional CO_2 laser resurfacing: the best fluences through a clinical, histological, and ultrastructural evaluation

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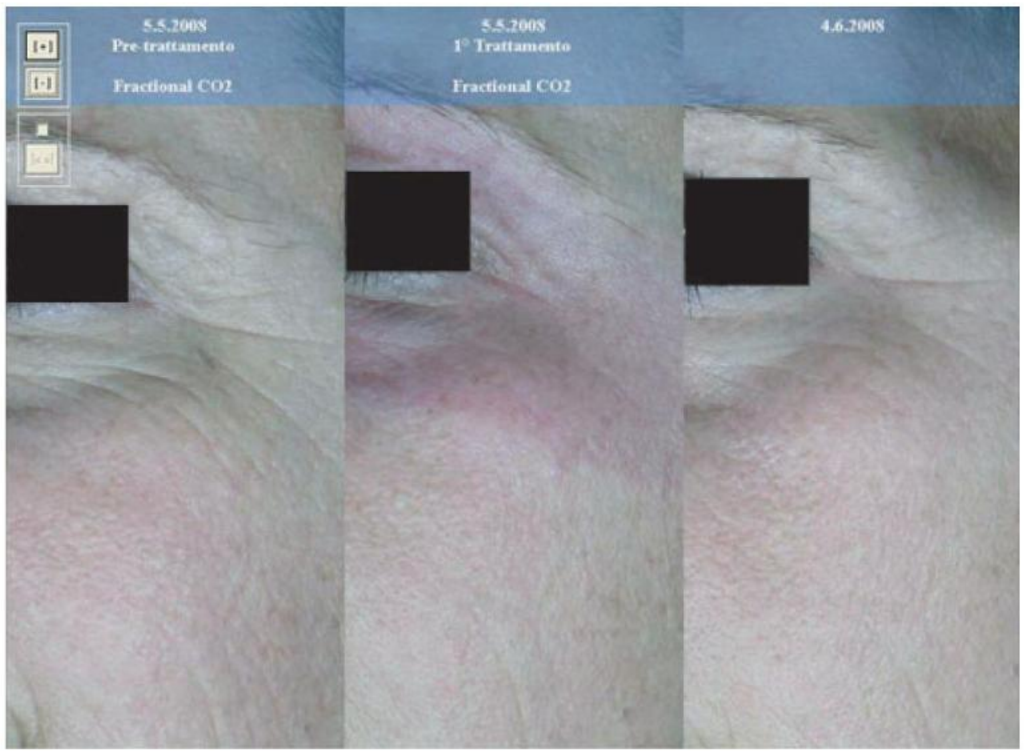

Figure 7 Clinical improvement of wrinkles: before treatment; upon 2.77 J/cm^2 immediately after treatment; upon 2.77 J/cm^2 after 1 month.

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Figure 8 Clinical improvement of hyperpigmentation: before treatment, after treatment upon 2.77 J/cm^2 after 2 months.

Journal of Cosmetic and Laser Therapy, 2012; 14: 267–271

informa healthcare

ORIGINAL RESEARCH REPORT

Induction of apoptosis by fractional CO_2 laser treatment

FRANCESCA PRIGNANO, FEDERICA RICCERI, PAOLO BONAN,
GIOVANNI CANNAROZZO & PIERO CAMPOLMI

Division of Clinical, Preventive and Oncology Dermatology, Department of Critical Care Medicine and Surgery, University of Florence, Florence, Italy

Introduction: Fractional CO2 -laser is considered a preferential method for skin resurfacing, but little is known about the molecular mechanisms underlying this surgical tool. In the present study, we investigated the possible role of apoptosis by the sequential analysis of lesional skin after laser treatment, with special attention to power. Moreover, we have analyzed if there is a correlation with clinical improvement.

Materials and methods: We evaluated the effects of fractional CO2-laser in twelve patients with photodamage skin Fitzpatrick types I to III. Apoptosis markers were assessed by an immunohisto-chemical study on skin samples of foream at 24 h, 72 h and 7 days after the irradiation with 15 W or 20 W. Moreover, clinical improvement was assessed by iconography.

Results: Fractional CO2-laser induced an inflammatory repair process mediated by activation of apoptotic pathway that was completed in 7 days. The expression of proapoptotic markers, as annexin-VII and Caspases-9 was increased 24–72 hours after irradiation and decreased after 7 days. While the expression of the anti-apoptotic marker Bcl-2 increased progressively during 7 days after treatment.

Conclusion: Our study suggests that the skin's appearance may be enhanced by creating skin changes through apoptosis. Apoptosis, one of the major mechanisms of cell death, might play a key role in initiating the paracrine cascades that lead to cell proliferation.

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ORIGINAL RESEARCH REPORT

Induction of apoptosis by fractional CO_2 laser treatment

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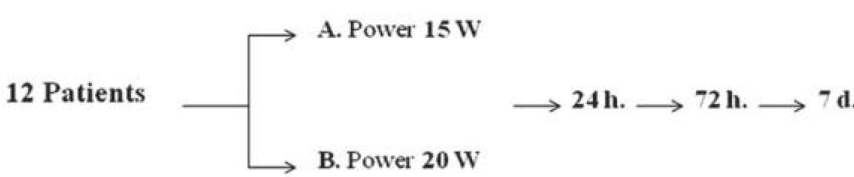

Figure 1. Study design schema.

Figure 2 (panel A) shows the expression and the localization of Caspases-9 (a), Annexin VII (b) and Bcl-2 (c) proteins after 15 W irradiation. An early increase (within 24 hours) was observed in the Annexin VII and Caspase-9 expression; the expression of the anti-apoptotic, heat-regulated molecule Bcl-2 remained unaltered at the same time point.

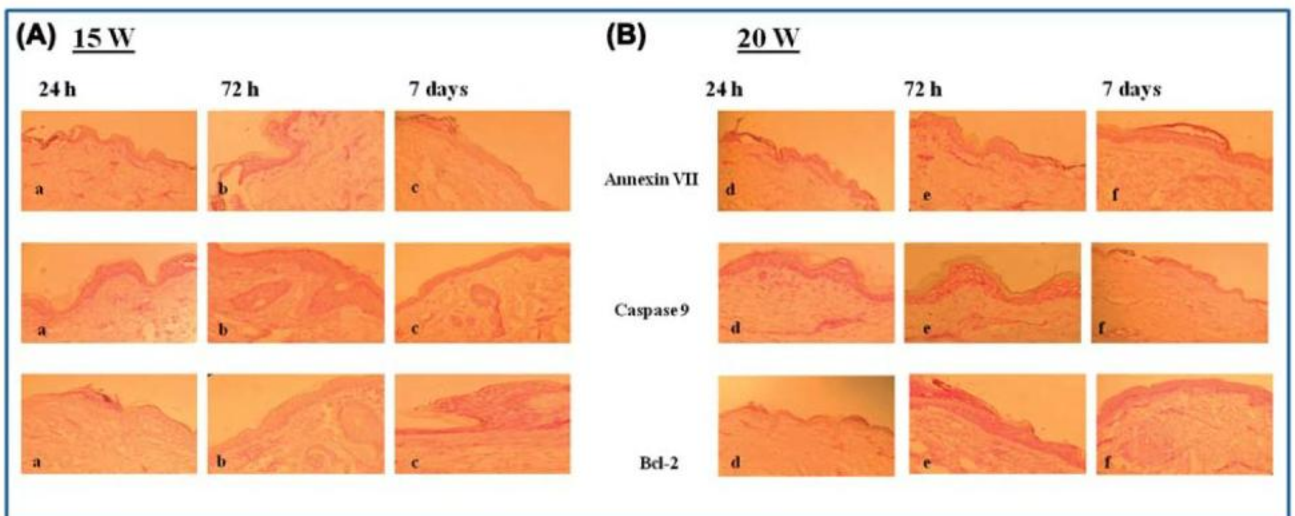

Figure 2. Representative immunohistochemistry (alkaline phosphatase-anti-alkaline phosphatase) stained skin sections of tissue harvested 24 hours, 72 hours and 1 week following delivery of 15 W (panel A) and 20 W (panel B) fractional CO_2 laser irradiation (magnification × 150).

At 72 hours after irradiation the Caspase-9 and Annexin VII expression remained increased throughout the epidermis and nearby areas; expression of these molecules returned to baseline after 7 days. Interestingly, the expression of Bcl-2, an anti-apoptotic marker, increased, when the expression of the two pro-apoptotic markers decreased.

After 20 W irradiation (Figure 2, panel B), no change in expression was found, except for a more strong expression of the protein in the dermis.

Induction of apoptosis by fractional CO_2 laser treatment

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Figure 3. 15 W treatment: a quick recovery time (2–4 days), a good reduction of visible fine lines, a good improvement in the skin texture and a fair clearance of irregular pigmentations.

Figure 4. 20 W treatment: a longer recovery time with a longer-lasting erythema, reduction of visible fine lines, a good improvement in skin texture and a fair clearance of irregular pigmentations.

The six patients belonging to group A (treated at 15 W) showed a rapid recovery time (2–4 days), a good reduction of visible fine lines, a good improvement in the skin texture, and a fair clearance of irregular pigmentations (Figure 3).

The six patients belonging to group B (treated at 20 W) had a slightly longer healing time compared to group A (3–5 days); more pain during each single treatment with the same clinical results at 15 W (Figure 4).

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Skin Rejuvenation

Wrinkles, Skin Texture and Skin Laxity

DOI: 10.1111/jdv.12029

ORIGINAL ARTICLE

Efficacy and safety evaluation of an innovative CO_2 laser/radiofrequency device in dermatology

P. Campolmi, P. Bonan, G. Cannarozzo, N. Bruscino,* S. Moretti

Background: CO2 laser has not only become the most widely used laser in dermatological surgical practice, but it has also proved to be highly effective in treating aesthetic imperfections.

Objective: To examine the efficacy and safety of a novel fractional CO2 laser combined with a radiofrequency device in different dermatological, surgical and aesthetic fields.

Methods: A total of 79 patients were treated in our Outpatient Service with a novel fractional CO2 laser combined with a bipolar radiofrequency device for a maximum of 5 months. Group A consisted of 39 patients with lesions requiring complete excision, whereas Group B consisted of 40 subjects seeking to enhance aesthetic facial imperfections. The results were assessed by three 'blind' investigators using photographs and clinical observations; in addition, the patients had to give their own subjective assessment of the results.

Results: At the 6-month follow-up, the lesions of the Group A patients had been completely removed, except for one case of a large sebaceous nevus on the scalp. All the Group B patients showed global improvement in skin tightening, removal of fine lines and rhytides and correction of dilated pores and hyperpigmentation, with no significant side-effects and short downtimes.

Conclusion: This kind of laser meets the needs of the majority of dermatologists requiring a unique, versatile tool to remove cutaneous lesions and at the same time, safely and effectively treat skin imperfections.

DOI: 10.1111/jdv.12029

ORIGINAL ARTICLE

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Figure 5 (a) Nevus sebaceous of the right mandibular region. (b) Successful removal of the lesion at the 6-month follow-up, absent on palpation, but with slight hyperpigmentation persisting due to the high phototype of the patient and inadequate sunscreen protection by patient.

Figure 6 (a) The left cheek of a 69-year-old patient with marked signs of ageing, particularly lines and wrinkles. (b) The typical erythema appeared after the first laser treatment. It is easy to note the single DOTs and network due to the 'overlapping effect'. (c) After four laser applications, most of the wrinkles and the rhytides on the cheek have disappeared. (d) At the 3-month follow-up, there was a marked improvement in the texture with increased skin smoothness. Clinical differences are evident compared to the untreated area around the eyes.

DOI: 10.1111/jdv.12029 JEADV

ORIGINAL ARTICLE

Efficacy and safety evaluation of an innovative CO_2 laser/radiofrequency device in dermatology

P. Campolmi, P. Bonan, G. Cannarozzo, N. Bruscino,* S. Moretti

Figure 7 A The left cheek of a 43-year-old female patient with visibly dilated pores.B. After three laser sessions, most of the pores have disappeared or been reduced in size, with improved smoothness of the skin in that area.

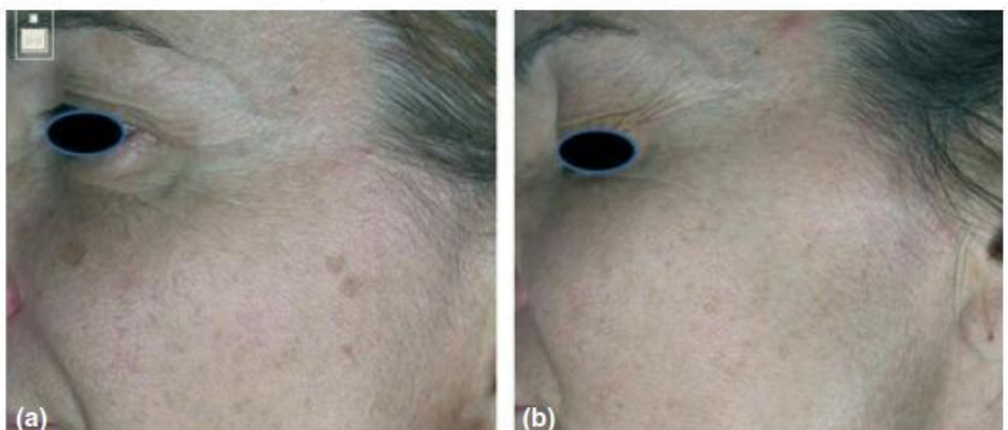

Figure 8 (a) Other typical hallmarks of ageing with hyperpigmentation on the left cheek. (b) After four laser treatments the patient's previous hyperpigmentation had disappeared; at the 3-month follow-up there were no recurrences.

DOI: 10.1111/jdv.12029

ORIGINAL ARTICLE

Efficacy and safety evaluation of an innovative CO_2 laser/radiofrequency device in dermatology

P. Campolmi, P. Bonan, G. Cannarozzo, N. Bruscino,* S. Moretti

Figure 9 (a) Patient with severe signs of facial ageing. (b) Result after three treatments with very low parameters.

Research Article

Highlights of Thirty-Year Experience of CO_2 Laser Use at the Florence (Italy) Department of Dermatology

Piero Campolmi, Paolo Bonan, Giovanni Cannarozzo, Andrea Bassi, Nicola Bruscino, Meena Arunachalam, Michela Troiano, Torello Lotti, and Silvia Moretti

The CO_2 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 system 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, and 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 see with older methods, using higher power. The percentage of after-treatment keloids and hypertrophic scars oberved 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 diathermocoagulatiopn 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.

Research Article

Highlights of Thirty-Year Experience of CO_2 Laser Use at the Florence (Italy) Department of Dermatology

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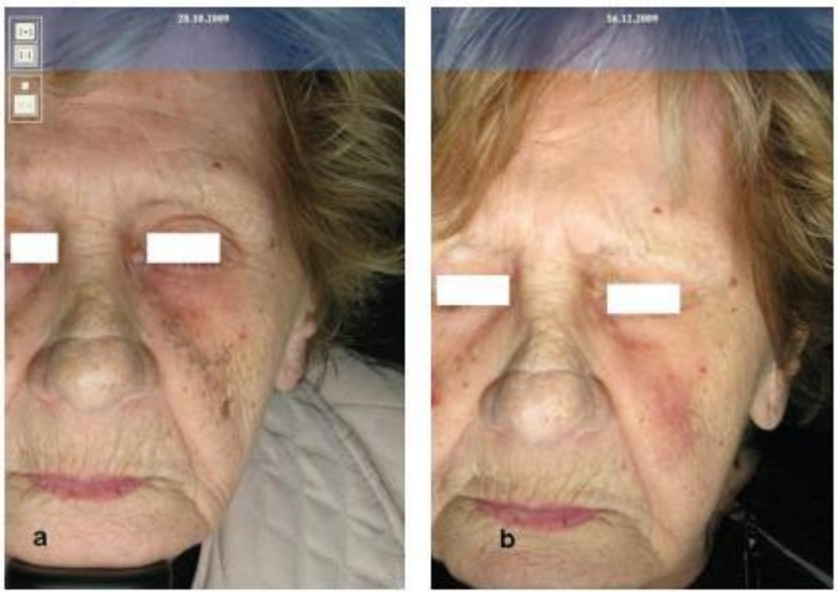

(a) (b)

Figure 5: Favre-Racouchot's disease at first **(a)** and after **(b)** one treatment with CO2 laser

(a) (b)

Figure 6: Facial wrinkles at first **(a)** and after **(b)** three treatments with fractional microablative CO2 laser.

Photobiomodulation, Photomedicine, and Laser Surgery
Volume 41, Number 7, 2023

Pp. 1–7
DOI: 10.1089/photob.2023.0015

Original Research

Clinical Evaluation and Experience in Treatments Performed with Fractional CO_2 Laser on Latin American Skin: An Observational Retrospective Study

Gabriella Benites Andrade, MD,[1] Pamela Montaño Salguero, MD,[1]
Irene Fusco, PhD,[2] and Daniel Ricardo Galimberti, MD[3]

Background: The carbon dioxide (CO2) laser is an ablative system that evaporates, remodels, and coagulates tissues, becoming therefore a gold standard piece of equipment for the treatment of dermatological pathologies and esthetic imperfections.

Objective: To evaluate the efficacy and safety of CO2 laser treatments in different patients' skin pathologies.

Methods: A total of 705 patients with an age range between 18 and 70 years, with phototypes on the Fitzpatrick scale III, IV, V, and VI, were enrolled from October 2021 to May 2022, and were treated using the CO2 laser system.

Results: Ninety-six patients were treated with fractional CO2 laser, used for skin rejuvenation and stretch marks. One patient presented reactivation of herpes simplex, 10 postinflammatory hyperpigmentation that resolved after 3 months with depigmenting agents, 6 with persistent erythema. A total of 13 patients with rhinophyma were treated, and no complications were observed; a total of 64 patients with wrinkles were treated. They improved in 6 months. A total of 340 patients were treated for seborrheic keratosis, papulosa nigra dermatosis, fibropapillomas, sebaceous hyperplasias, verruca vulgaris, and condylomata acuminata. One patient presented with a complication hypopigmented macule. A total of 136 patients underwent treatment for laser ablation of intradermal nevi and verrucous epidermal nevi, without complications. A total of 56 patients were treated with keloids and hypertrophic scars. One patient presented with ulceration of a keloid that resolved with the application of clostridiopeptidase A and chloramphenicol after 2 weeks.

Conclusions: The use of the CO2 laser in any phototype and race, which are factors with a high incidence in Latin America, provides a safe and effective result for different dermatological pathologies

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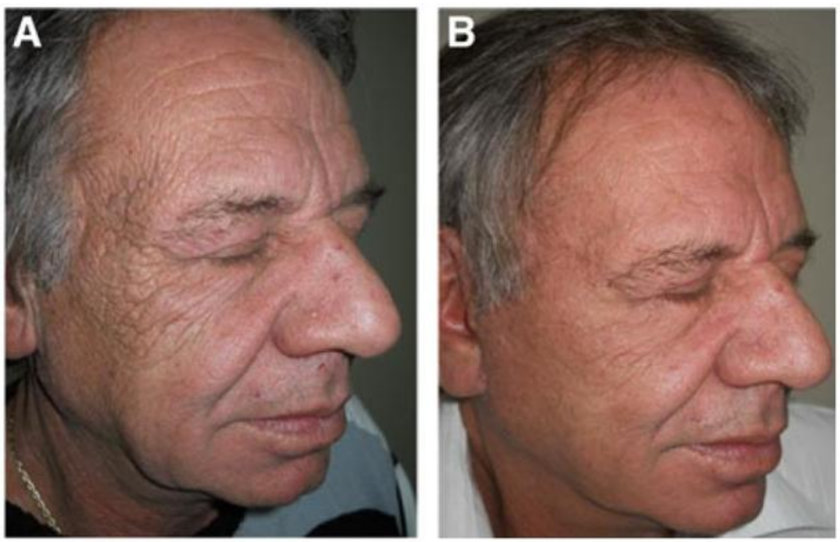

Fig 3. Lateral view of a male patient before **(A)** and after **(B)** Glide CO2 laser treatment. A visible improvement of patient's ocular intradermal nevus in upper lid area, skin texture, and wrinkles was achieved. For wrinkles, treatment, emission mode HP with fluence 1.86-3-30 J/cm2, power 6-10W, DP duration 500-800 us, and DOT spacing 400-500 um was set. For ocular intradermal nevus management, the ultrapulsed emission mode with power rangign from 0.5 to 2 W was selected.

Fig 4: Lateral view of a female patient before **(A)** and after**(B)** Glide CO2 laser treatment. A clear esthetic improvement of skin texture, wrinkles, treatment, emission mode HP with fluence 1.86-3.30 J/cm2, power 6-10W, DP duration 500-800 us, and DOT spacing 400-500 um was set.

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Original Research

Clinical Evaluation and Experience in Treatments Performed with Fractional CO_2 Laser on Latin American Skin: An Observational Retrospective Study

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Irene Fusco, PhD,[2] and Daniel Ricardo Galimberti, MD[3]

TABLE 2. PERCENTAGE OF TOTAL INCIDENCE AND INCIDENCE ON TYPE OF PROCEDURE OF SIDE EFFECTS EXAMINED

Side effect	n	*Phototype distribution*	*Procedures*	*Incidence on type of procedure (%)*	*Total incidence (%)*
Herpes simplex	1	III:1	Acne	1	0.1
3 months PIH	10	III:5, IV:3, V:2	Acne, striae	8.3	1.2
Persistent erythema	6	III:4, IV:2	Acne, striae	5.0	0.7
6 months hypopigmentation	2	V:1, VI:1	Syringomas, accuminate condylomas	2.1	0.1
2 weeks ulceration	1	IV:1	Keloids, hypertrophic scar	1.8	0.1

PIH, postinflammatory hyperpigmentation.

ORIGINAL ARTICLES
SPECIAL TOPIC
Journal of Drugs in Dermatology

Multi-Center Clinical Study and Review of Fractional Ablative CO_2 Laser Resurfacing for the Treatment of Rhytides, Photoaging, Scars and Striae

Macrene Alexiades-Armenakas MD PhD FAAD,[1] Deborah Sarnoff MD, Robert Gotkin MD, Neil Sadick MD
[1]Assistant Clinical Professor, Yale University School of Medicine;
Director and Founder of the Dermatology and Laser Surgery Center, New York, NY

Abstract:
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.

Journal of Drugs in Dermatology

ORIGINAL ARTICLES

SPECIAL TOPIC

Multi-Center Clinical Study and Review of Fractional Ablative CO_2 Laser Resurfacing for the Treatment of Rhytides, Photoaging, Scars and Striae

Macrene Alexiades-Armenakas MD PhD FAAD,[1] Deborah Sarnoff MD, Robert Gotkin MD, Neil Sadick MD

[1]Assistant Clinical Professor, Yale University School of Medicine; Director and Founder of the Dermatology and Laser Surgery Center, New York, NY

Fractional CO2 laser resurfacing for the treatment of rhytides and photoaging. The baseline and post-treatment photographs of a subject treated at site number one (MAA) are shown, with demonstrable improvements in rhytides, dyspigmentation and vascularity, and a milder improvement in skin laxity.

Sample Parameters According to Indication and Recovery Time for SmartXide DOT

Sample Indication	W	Dot spacing	Dwell time	Recovery time
Lentigines photoaging	20	500	700	3 days
Moderate rhytides	25	650	850	5 days
Deep rhytides	30	800	>1000	7 days

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SPECIAL TOPIC

Multi-Center Clinical Study and Review of Fractional Ablative CO_2 Laser Resurfacing for the Treatment of Rhytides, Photoaging, Scars and Striae

Macrene Alexiades-Armenakas MD PhD FAAD,[a] Deborah Sarnoff MD, Robert Gotkin MD, Neil Sadick MD
[a]Assistant Clinical Professor, Yale University School of Medicine;
Director and Founder of the Dermatology and Laser Surgery Center, New York, NY

Acne scars treated with fractional CO2 laser resurfacing. Significant reduction of acne scars is shown in this subject treated at site number one (MAA).

Fractional CO2 laser resurfacing for the treatment of striae distensae. The clinical outcomes in the treatment of this condition were variable and inconsistent. Shown here is one case where improvement was noted.

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FIGURE 4. Fractional CO2 laser resurfacing for the treatment of rhytides and photoaging. A significant improvement was noted in this case, which was treated at site number two employing more aggressive parameters.

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SPECIAL TOPIC

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Figure 5: Fractional CO2 laser resurfacing for the treatment of rhytides and photoaging. A clinical outcome from clinical site number three (NS)

Rejuvenescimento Perioral com Laser de Dióxido de Carbono (CO_2) Fracionado

Artigo Original

Perioral rejuvenation with fractional carbon dioxide (CO_2)laser

Introduction: Several therapeutic modalities, such as surgeries, cutaneous filling, and ablative techniques are used for perioral rejuvenation.

Objective: The repsent study was aimed at evaluating the efficacy and side effects of an ablative method, using fractional carbon dioxide (CO2) laser in the treatment of perioral wrinkles.

Methods: A retrospective study was carried out with 20 female patients who underwent a single session of fractionalCO2 laser, with high energy and density, for the treatment of perioral wrinkles. Photographs taken before and 90-days after the procedure were evaluated by two examiners unrelated to the study, who looked at the effect of the laser on the deep static wrinkles, fine lines, skin texture and color. The patients were also classified, pre-and post- treatment, according to the classification of Baker for perioral wrinkles.

Results: Three months after the treatment, it was possible to observe clinical improvement in 100% of the patients, in all the variables evaluated. In the classification of Baker, five patients classified as Grade II, and three who classified as grade III became Grade I and Grade II, respectively. Patients initially classified as Grade I did not have alteration in their classification for presenting few superificial wrinkles. Observed side effects were: transient erythema and edema in the early post-procedure period.

Conclusion: Fractional CO2 laser has proven to be a safe and effective option for the treatment of perioral wrinkles.

Rejuvenescimento Perioral com Laser de Dióxido de Carbono (CO_2) Fracionado

Perioral rejuvenation with fractional carbon dioxide (CO_2)laser

Artigo Original

Figure: Perioral rejuvenation with CO2 fractional laser :
(A) at baseline and
(B) at 90 days after the treatment.

Ablative Skin Resurfacing With a Novel Microablative CO_2 Laser

Robert H. Gotkin MD,[a] Deborah S. Sarnoff MD,[b] Giovanni Cannarozzo MD,[c] Neil S. Sadick MD,[d]
Macrene Alexiades-Armenakas MD PhD[e]

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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 post-operative photographic evaluation by an independent physicians, not involved in the treated, 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%).

Journal of Drugs in Dermatology

Ablative Skin Resurfacing With a Novel Microablative CO_2 Laser

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Macrene Alexiades-Armenakas MD PhD[e]

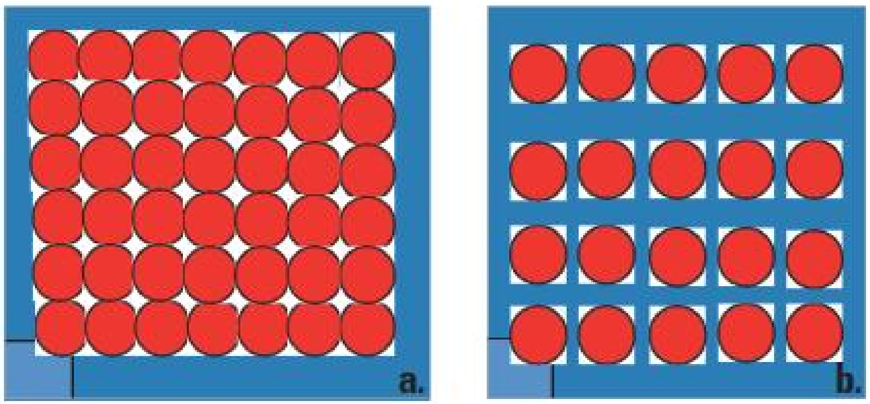

FIGURE 1. a) Red areas are the zones of ablation in fully ablative standard resurfacing; **b)** Red areas are the microscopic treatment zones (MTZs) of fractional photothermolysis (FP) and the blue areas are the bridges of intact, unaltered skin.

FIGURE 2. Variations in DOT pitch – the spacing between the DOTS, or microscopic treatment zones – one of the variables that confer versatility in treatment with the microablative CO_2 laser system.

FIGURE 9. Before (left) and 6 months after (right) single treatment for full face and neck resurfacing with the microablative CO_2 laser at 30 W, 2000 µsec, 200 µm on the face and 25 W, 1000 µsec, 500 µm on the neck (1 pass).

Ablative Skin Resurfacing With a Novel Microablative CO_2 Laser

Robert H. Gotkin MD,[a] Deborah S. Sarnoff MD,[b] Giovanni Cannarozzo MD,[c] Neil S. Sadick MD,[d] Macrene Alexiades-Armenakas MD PhD[e]

FIGURE 4. a) Upper lip prior to microablative laser treatment. **b)** Upper lip 6 months after a single treatment at 25 W, 1 ms, 500 µm DOT spacing.

FIGURE 5. Before (left) and 6 months after (right) a single treatment with the microablative CO_2 laser at 22 W, 750 µsec, 500 µm DOT spacing.

FIGURE 6. Before (left) and 6 months after (right) single treatment full face resurfacing with the microablative CO_2 laser. Perioral area treated at 30 W, 1700 µsec, 200 µm DOT spacing (2 passes). The periorbital area was treated at 20 W, 800 µsec, 500 µm DOT spacing (one pass) and the remainder of the face treated at 25 W, 1500 µsec, 500 µm (2 passes).

FIGURE 7. Before (left) and 6 months after (right) a single treatment with the microablative CO_2 laser at 30 W, 1500 µsec, 500 µm DOT spacing (2 passes).

Ablative Skin Resurfacing With a Novel Microablative CO_2 Laser

Robert H. Gotkin MD,[a] Deborah S. Sarnoff MD,[b] Giovanni Cannarozzo MD,[c] Neil S. Sadick MD,[d] Macrene Alexiades-Armenakas MD PhD[e]

TABLE 2.

Graded improvement by patients at various times postoperatively

Posttreatment	Total patients (N=32)	Patients with rhytides (n = 18)	Patients with lentigines and solar elastosis (n = 8)	Patients with acne scars (n = 4)	Patients with striae (n = 2)
1 month	3.75	3.89	3.75	3.50	3.00
3 months	3.56	3.83	3.63	2.75	2.50
6 months	3.53	3.78	3.75	2.50	2.50

TABLE 3.

Graded improvement by independent physician evaluator at various times postoperatively

Posttreatment	Total patients (N=32)	Patients with rhytides (n = 18)	Patients with lentigines and solar elastosis (n = 8)	Patients with acne scars (n = 4)	Patients with striae (n = 2)
1 month	3.69	3.89	3.88	3.00	2.50
3 months	3.56	3.89	3.75	2.50	2.00
6 months	3.47	3.83	3.75	2.00	2.00

TABLE 1.

Presence of side effects following ablative fractional resurfacing (N=32)

Posttreatment	Edema	Erythema	Oozing or bronzing	Milia	Dyschromia (PIH)
2 days	32	32	32	0	0
7 days	32	32	24	0	0
14 days	21	27	2	1	0
1 month	15	3	0	6	13
3 months	0	0	0	2	0
6 months	0	0	0	0	0

FIGURE 8. Before (left, top and bottom) and 6 months after (right, top and bottom) single treatment for full face microablative CO_2 laser resurfacing at 30 watts, 2000 µsec, 200 µm DOT spacing (1 pass).

Original Contribution

Journal of Cosmetic Dermatology, **11**, 201–206

Skin tightening induced by fractional CO_2 laser treatment: Quantified assessment of variations in mechanical properties of the skin

Michael Naouri, MD,[1,2,3,4,5] Michael Atlan, MD, Msc,[1,4,6] Elodie Perrodeau, MSc,[7] Gabriela Georgesco, MD,[2,3] Randa Khallouf, MD,[3,4] Ludovic Martin, MD, PhD,[8] & Laurent Machet, MD, PhD[1,2,3]

Background: Certain authors have reported the efficacy of fractional resurfacing laser treatment in patients with photodamaged skin resulting in skin tightening of treated area.

Objective: To assess skin tightening after CO(2) fractional resurfacing laser treatment by measuring variations in mechanical properties in treated areas. Dermal elasticity was measured using suction applied with an in vivo skin elasticity meter (Cutometer(®)).

Methods: A prospective observational study was undertaken from January 2007 to August 2009. Laser treatment was performed with the SmartXide Dot(®) (Deka(®), Firenze, Italy) CO(2) fractional resurfacing device. Patients were offered quantified analysis using the Cutometer(®) before and after treatment.

Results: Seventeen patients (61 areas treated) were included in the study. Median delay between before and after cutometric evaluations was 80 days. We found **significant improvement in elastic (R2 +5.9%), viscoelastic (R8 -9.4%), fatigue (R3 and R9 -16.2% and -19.7%, respectively), and thickness (R0 -14.9%) parameters**. **These results are consistent with significant tightening and also elastic tissue improvement.**

Conclusions: It was possible to quantify skin tightening because of CO(2) fractional laser treatment using a noninvasive technique.

Original Contribution

Journal of Cosmetic Dermatology, **11**, 201–206

Skin tightening induced by fractional CO_2 laser treatment: Quantified assessment of variations in mechanical properties of the skin

Michael Naouri, MD,[1,2,3,4,5] Michael Atlan, MD, Msc,[1,4,6] Elodie Perrodeau, MSc,[7] Gabriela Georgesco, MD,[2,3] Randa Khallouf, MD,[3,4] Ludovic Martin, MD, PhD,[8] & Laurent Machet, MD, PhD[1,2,3]

Figure 3 Patient with acne scar and photoaging.

Figure 4 Same patient after laser treatment. Improvement of acne scars and skin tightening.

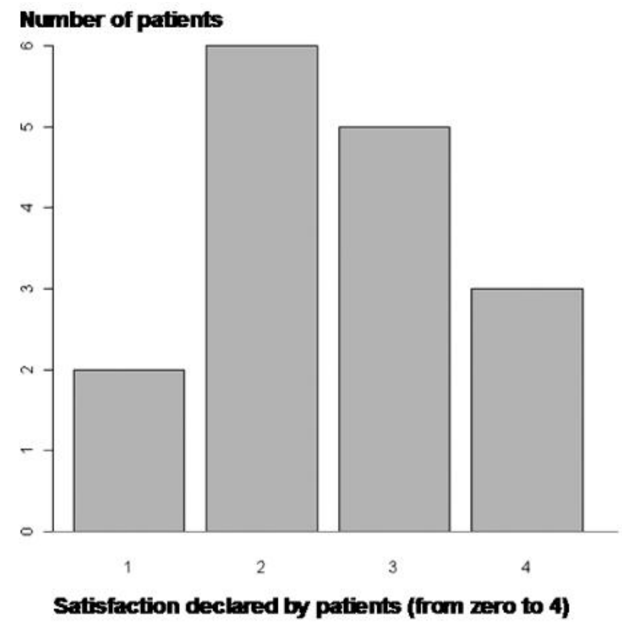

Figure 2 Patients' self-assessed satisfaction (n = 16, one data missing). Median satisfaction [Q1; Q3]: 2.5 [2; 3].

The Safety of Laser Skin Resurfacing With the Microablative Carbon Dioxide Laser and Review of the Literature

Deborah Sarnoff MD,[a] Robert H. Gotkin MD,[b] Laura B. Doerfler MD,[c] Cheryl J. Gustafson MD,[c] C. William Hanke MD[c]

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[b]Lenox Hill Hospital / Northwell Health and Cosmetique Dermatology, Laser & Plastic Surgery, LLP, New York, NY
[c]Laser and Skin Surgery Center of Indiana, Carmel, IN

OBJECTIVE: The aim of this study was to evaluate the incidence of adverse effects following laser skin resurfacing with the microablative carbon dioxide (CO2) laser system (SmartXide DOT; DEKA, Calenzano, Italy).

METHODS: A retrospective chart review was performed. Data was collected for DOT laser procedures performed at three clinical centers from 2008-2014.

Results: Of the 1,081 DOT laser procedures, there were 13 complications (1.3% of all cases), which included eleven cases of prolonged erythema and two cases of post-inflammatory hyperpigmentation. Of note, there were no cases of scarring.

LIMITATIONS: This was a retrospective chart review. Data was collected from laser case logs. However, all patients with complications were evaluated clinically by a physician.

CONCLUSION: Microablative fractional resurfacing with the DOT laser enables treatment of a diversity of skin conditions with short post-procedure recovery time and an extremely low incidence of adverse side effects..

The Safety of Laser Skin Resurfacing With the Microablative Carbon Dioxide Laser and Review of the Literature

Deborah Sarnoff MD,[a] Robert H. Gotkin MD,[b] Laura B. Doerfler MD,[c] Cheryl J. Gustafson MD,[c] C. William Hanke MD[c]

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[c]Laser and Skin Surgery Center of Indiana, Carmel, IN

TABLE 1.

Laser Settings Utilized in Dot Laser Resurfacing Procedures

Investigator	Face				Neck			
	Power (watts)	Pitch Density (microns)	Dwell Time (millisec)	Passes	Power (watts)	Pitch Density (microns)	Dwell Time (millisec)	Passes
1	30	500	500	1-3	20	500	500	1
2	25-30	200-500	1800-2000	2-3	20	200-500	1000	1
3	20-30	200-500	1000-1500	1-3	20	400	1000	1

TABLE 2.

Complications in Dot Laser Resurfacing Procedures

Complication	Number (%)	Comment
Prolonged erythema > 4 weeks	11 (1%)	Face (1); Neck (4); Eyelids (1); Nose (2); Chest (1); Back (2)
Post-inflammatory hyper-pigmentation	2 (0.2%)	Face (1); Chest (1)
Permanent hypo-pigmentation	0	-
Scaring	0	-

The Safety of Laser Skin Resurfacing With the Microablative Carbon Dioxide Laser and Review of the Literature

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TABLE 2.

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Post-inflammatory hyper-pigmentation	2 (0.2%)	Face (1); Chest (1)
Permanent hypo-pigmentation	0	-
Scaring	0	-

TABLE 3.

Complications in Fractional Ablative Resurfacing Procedures			
Author	Laser type	Area(s) treated	Complication
Metelitsa et al	Literature review of all fractional lasers	Face	12.5% prolonged erythema 1-32% post-inflammatory hyperpigmentation
Rahman et al	Prototype fractional CO2 laser device (Reliant Technologies Inc.)	Face	33% prolonged erythema 20% post inflammatory hyperpigmentation no reports of scarring or hypopigmentation
Clementoni et al	Ultrapulse CO2	Face	2.24% prolonged erythema 5.64% post inflammatory hyperpigmentation no reports of scarring
Fitzpatrick et al	Ultrapulse CO2	Neck	30% hypertrophic scarring 40% permanent hypopigmentation
Avram et al	Fraxel re:pair	Neck	Series of 5 patients with scarring on neck
Ross et al	Active FX fractionated CO2	Neck	Single case of persistent erythema and scarring

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

Emily P. Tierney, MD,*† and C. William Hanke, MD, MPH†

Background: Ablative fractionaql 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.

Material 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 treatment 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 avents of scarring, prolonged erythema(lasting more than 7 days), postinflammatory hyper-or hypopigmentation, or infection ine 108 treatment sessions given during this study. Mean improvement was 48.5% for skin texture, 50.3% for skin laxity, 53.9% for dyschromia and 52.4% for overal cosmetic outcome.

Conclusion: 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.

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

EMILY P. TIERNEY, MD,*† AND C. WILLIAM HANKE, MD, MPH†

Figure 1. (A) Before (left) and (B) after (right) two treatments of the face in a 74-year-old Caucasian man using ablative fractional photothermolysis (SmartXide DOT, DEKA, Calenzano, Italy) at settings of 30 W, 1,500 μs, and 500 μm. Degree of improvement: 67% in skin texture, 50% in laxity, 57% in dyschromia.

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

EMILY P. TIERNEY, MD,*† AND C. WILLIAM HANKE, MD, MPH†

Figure 2. (A) Before (left) and (B) after (right) two treatments of the face in a 62-year-old Caucasian woman using ablative fractional photothermolysis (SmartXide DOT, DEKA, Calenzano, Italy) at settings of 30 W, 1,000 μs, and 500 μm. Degree of improvement: 50% in skin texture, 33% in laxity, 57% in dyschromia.

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

EMILY P. TIERNEY, MD,*† AND C. WILLIAM HANKE, MD, MPH†

Figure 3. (A) Before (left) and (B) after (right) two treatments of the face in a 62-year-old Caucasian woman using an ablative fractional carbon dioxide laser (SmartXide DOT, DEKA, Calenzano, Italy) at settings of 30 W, 1,000 µs, and 500 µm. Degree of improvement: 33% in skin texture, 25% in laxity, 67% in dyschromia.

DERMATOLOGIC SURGERY

The effect of cold-air anesthesia during fractionated carbon-dioxide laser treatment: Prospective study and review of the literature

Emily P. Tierney, MD,[a,b] and C. William Hanke, MD, MPH[b]
Boston, Massachusetts, and Carmel, Indiana

Background: Forced cold-air anesthesia has been reported to decrease the discomfort associated with various dermatologic laser therapies.

Objective: We sought to evaluate the effect of cold-air anesthesia on patient comfort during ablative fractionated carbon-dioxide (CO2) laser treatment for photoaging.

Methods: We conducted a prospective split-face study to evaluate the effect of cold-air anesthesia on patient comfort during ablative fractionated CO2 laser treatment for photoaging. Both patients and physicians rated the perceived discomfort of the treatment on each half of the face on a pain scale of 0 to 10. In addition, patients were asked to evaluate the side effects of the procedure (erythema, edema, crusting, scaling) on each half of the face. At 6 months posttreatment, blinded physician photograph evaluation was performed of 5 clinical indicators of photoaging.

Results: For the side of the face treated with topical anesthesia alone, the mean patient-reported pain score was 7.47. On the side treated with cold-air anesthesia and topical anesthesia, the mean pain score was 4.27. For the side treated with topical anesthesia alone, the mean physician-reported pain score was7.8, relative to the side treated with cold-air anesthesia and topical anesthesia, for which the mean physician-reported pain score was 3.73.
Limitations: Although significant differences were found in pain tolerance with fractionated CO2 laser with the use and absence of forced-air cooling, additional large-scale studies are needed to confirm the device's use in patient tolerability and side-effect profile.

Conclusion: The use of forced cold-air device in conjunction with topical anesthesia provides a well-accepted modality for patient comfort during ablative fractionated CO2 resurfacing.

The effect of cold-air anesthesia during fractionated carbon-dioxide laser treatment: Prospective study and review of the literature

Emily P. Tierney, MD,[a,b] and C. William Hanke, MD, MPH[b]
Boston, Massachusetts, and Carmel, Indiana

Fig 1. Before (**A**) and after (**B**) treatment of 47-year-old Caucasian woman with ablative fractional photodermolysis, DOT (DEKA-Calenzano, Italy) at settings of 30 W, 500 microseconds, 500 μm, percentage improvement: 60% in dyschromia, 60% in skin texture, 50% in rhytids, 50% in skin laxity, 50% overall cosmetic outcome.

Fig 2. Before (**A**) and after (**B**) treatment of 65-year-old Caucasian woman with ablative fractional photodermolysis, DOT (DEKA-Calenzano, Italy) at settings of 30 W, 1000 microseconds, 500 μm, percentage improvement: 50% in dyschromia, 60% in skin texture, 40% in rhytids, 40% in skin laxity, 40% overall cosmetic outcome.

Journal of Cosmetic and Laser Therapy. June 2008 Volume 10 Number 2

Fractional Laser Skin Resurfacing with SmartXide DOT. Initial Results

Anne Le Pillouer-Prost[1], Nicola Zerbinati[2]
[1]Department of Dermatology, Clairval Hospital, Marseilles, France
[2]Department of Dermatology, University of Insubria, Varese, Italy

(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.

(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.

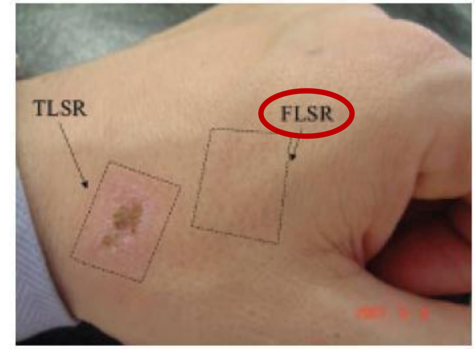

Figure 9. Comparison between TLSR (30W, Standard Mode, 200 μs) and FLSR (30W, DOT Mode, 2 ms, 1000 μm) effect, 1 month after the test.

(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.

Journal of Cosmetic and Laser Therapy. June 2008 Volume 10 Number 2

Fractional Laser Skin Resurfacing with SmartXide DOT. Initial Results

Anne Le Pillouer-Prost[1], Nicola Zerbinati[2]
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[2]Department of Dermatology, University of Insubria, Varese, Italy

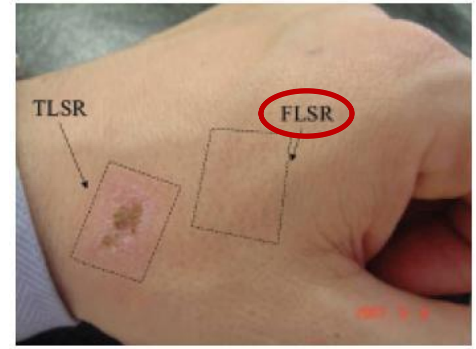

Figure 9. Comparison between TLSR (30W, Standard Mode, 200 μs) and FLSR (30W, DOT Mode, 2 ms, 1000 μm) effect, 1 month after the test.

(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.

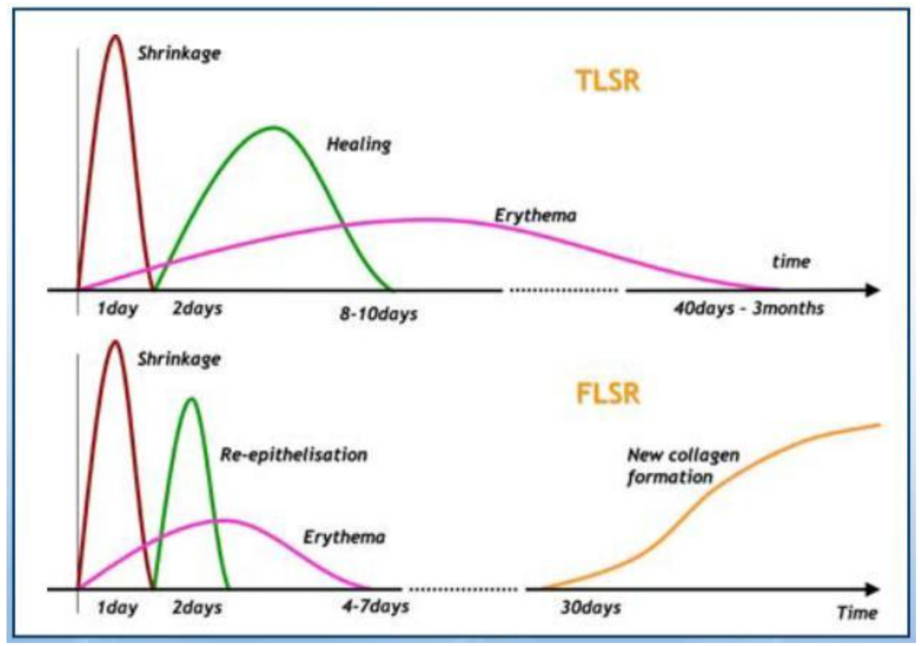

Figure 11. Recovery process comparison between TLSR and FLSR.

ORIGINAL ARTICLE

Preliminary Comparison of Fractional Laser with Fractional Laser Plus Radiofrequency for the Treatment of Acne Scars and Photoaging

NORMA CAMELI, PHD, MD, MARIA MARIANO, MD, MIRKO SERIO, MD, AND MARCO ARDIGÒ, MD*

Background: The therapeutic approach to the treatment of acne scars and photoaging varies according to the type of lesion. Traditional carbon dioxide (CO_2) laser is associated with long healing times, persistent erythema, and high risk of post-inflammatory hyperpigmentation. Fractional laser technology, which involves the application of microscopic beams of pixilated light inducing focal zones of tissue injury surrounded by normal tissue, is currently used for the treatment of acne scars and photoaging.

Objective: To compare the results obtained using CO_2 fractional laser with those obtained using CO_2 fractional laser plus radiofrequency for the treatment of atrophic acne scars and photoaging by means of clinical evaluation and confocal laser.

Materials and methods: Ten patients with photoaging and acne scars underwent a single treatment using both technologies. Investigators and patients evaluated the clinical effect of the treatments using digital photographs, dermatoscopy, and in vivo reflectance confocal microscopy before and immediately, 1 week, and 3 months after treatment.

Results and conclusion: Our results underlined the high efficacy of combining CO_2 laser and radiofrequency, producing better results with fewer sessions, lower risks, and fewer side effects.

Preliminary Comparison of Fractional Laser with Fractional Laser Plus Radiofrequency for the Treatment of Acne Scars and Photoaging

Norma Cameli, PhD, MD, Maria Mariano, MD, Mirko Serio, MD, and Marco Ardigò, MD*

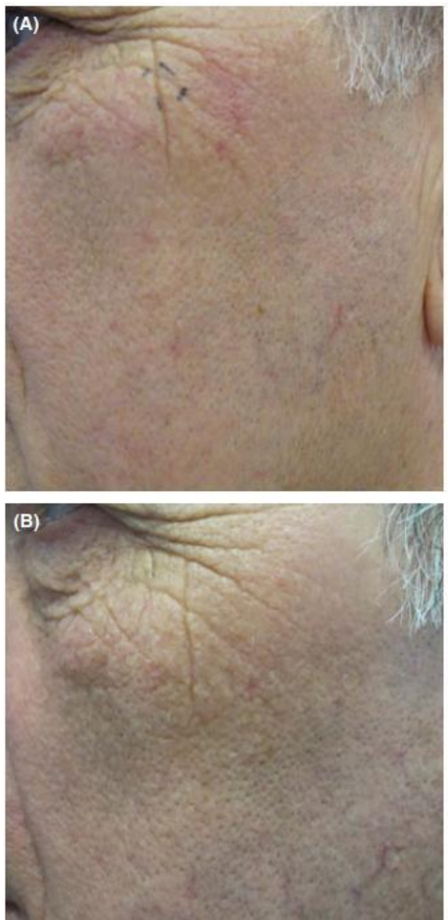

Figure 7. (A) Skin aging in a 55-year-old man (A) before and (B) after carbon dioxide (CO_2) laser treatment plus radiofrequency.

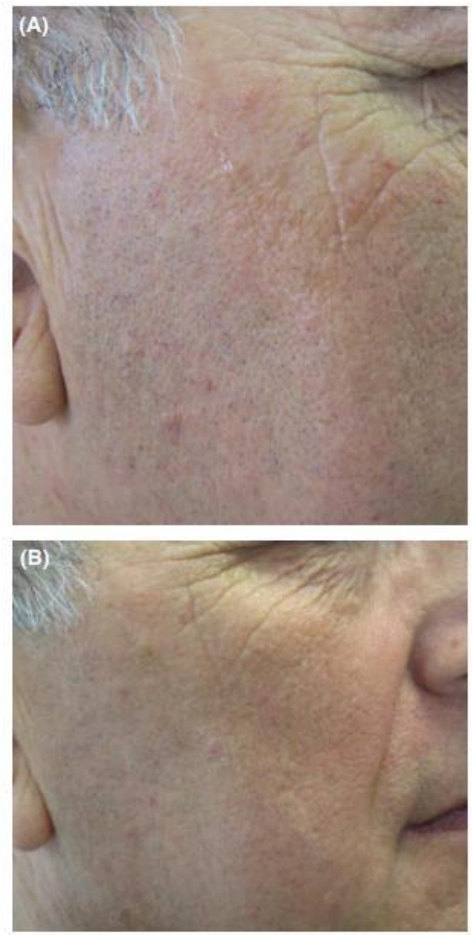

Figure 8. (A) Skin aging in a 55-year-old man (A) before and (B) after treatment with carbon dioxide (CO_2) laser alone.

A Preliminary Study on the Safety and Efficacy of a Novel Fractional CO_2 Laser With Synchronous Radiofrequency Delivery

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[a]Department of Surgery, Division of Plastic Surgery, North Shore/LIJ Lenox Hill Hospital, Private practice in Plastic Surgery, New York, NY
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Building upon the fractional CO_2 technology incorporated into the first generation SmartXide DOT (DEKA / ElEn, SpA, Calenzano, Italy) introduced in the U.S. in 2008, a second generation SmartXide Quadro has recently been introduced. This is a versatile device that has the ability to combine fractional CO_2 laser output for skin resurfacing with the synchronous delivery of bipolar radiofrequency (RF) energy for deeper, more diffuse heating. A pilot study was undertaken to demonstrate the safety and efficacy of the SmartXide Quadro, employing both fractional CO_2 laser output combined with the synchronous delivery of radiofrequency energy for the treatment of facial rhytides and acne scars. Ten patients, all women, six with facial rhytides and four with acne scarring, were treated with the SmartXide Quadro, a variably pulsed CO_2 laser with Pulse Shape Design® technology, a microablative DOT scanner and synchronized bipolar RF emission. Each patient was treated with a single fractional CO_2 laser-RF treatment; laser and RF parameters varied according to the severity of the rhytides or acne scars and were based upon both manufacturer-recommended settings and surgeon experience. Follow-up was at three days, one week, 2 weeks, and one month, three months, and six months after treatment. Results were judged by comparison of preoperative and post-operative photos evaluated by independent physicians, preoperative and post-operative grading by treating physicians, subjective evaluation of results by the patients themselves, and tabulation and categorization of adverse events (AEs). The SmartXide Quadro variably pulsed CO_2 laser with a microablative DOT scanner, with synchronous delivery of bipolar RF energy emission, proved to be both safe and effective in the treatment of facial rhytides and acne scars. The single treatment protocol was well tolerated and recovery was similar to fractional CO_2 laser skin resurfacing alone. The AEs were minimal and no significant complications occurred.

A Preliminary Study on the Safety and Efficacy of a Novel Fractional CO_2 Laser With Synchronous Radiofrequency Delivery

Robert H. Gotkin MD FACS[a,c] and Deborah S. Sarnoff MD FAAD FACP[b,c]

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FIGURE 1. 69-year-old woman (Subject 1 in Table 2) before **a,b)** and 8 months after full face treatment **c,d)** with synchronous fractional CO_2 laser and RF energy for rhytides.

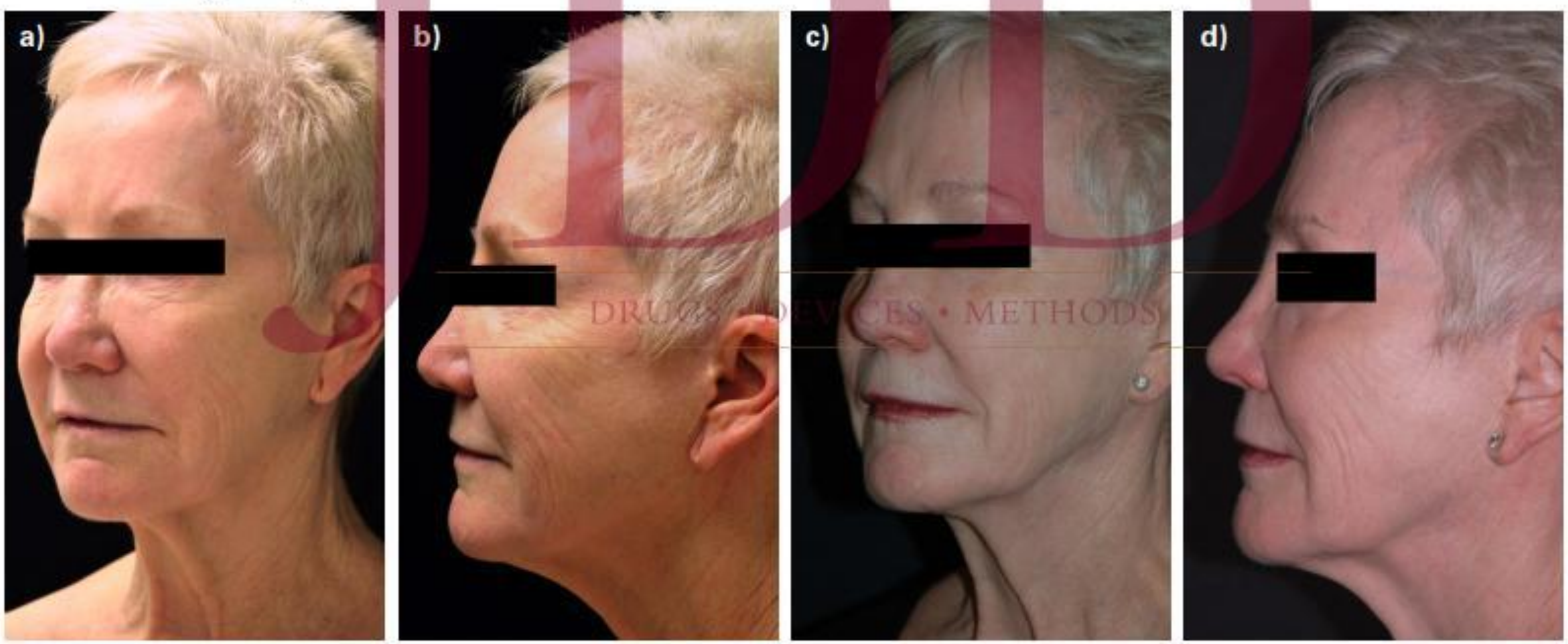
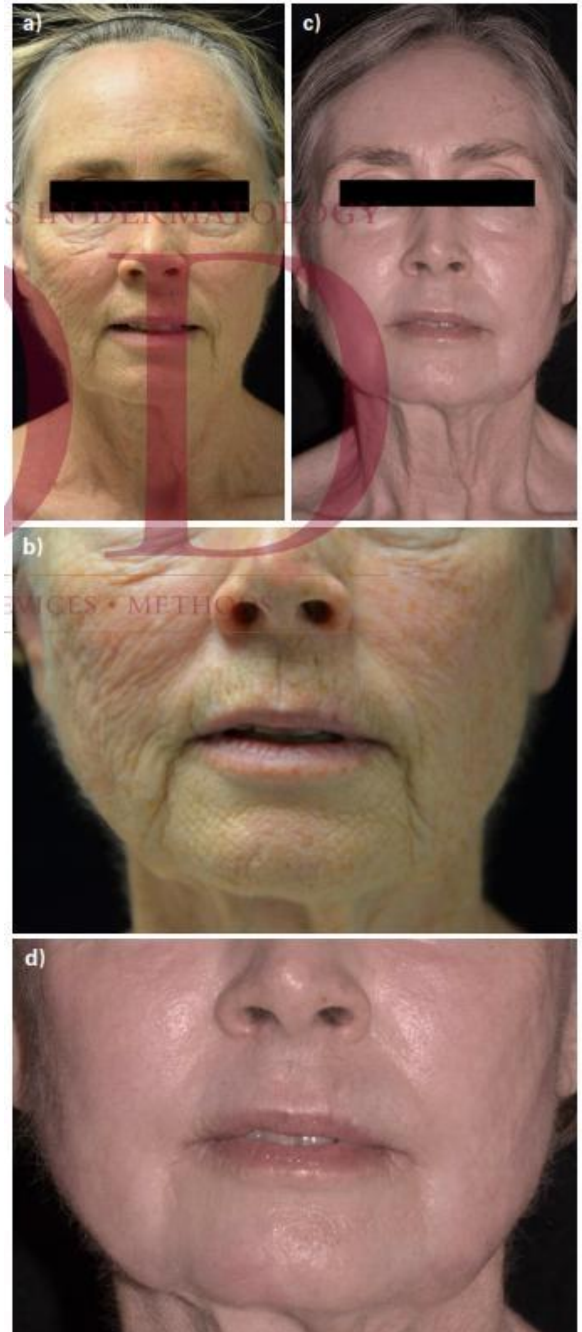


FIGURE 3. 67-year-old woman (Subject 10 in Table 2) before **a,b)** and 12 months after full face treatment **c,d)** with synchronous fractional CO2 laser and RF energy for severe rhytides.



A Preliminary Study on the Safety and Efficacy of a Novel Fractional CO_2 Laser With Synchronous Radiofrequency Delivery

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FIGURE 2. 43-year-old woman (Subject 9 in Table 2) before **a)** and 7 months after full face treatment **b)** with synchronous fractional CO2 laser and RF energy for acne scarring.

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ORIGINAL CONTRIBUTION

JCD Journal of Cosmetic Dermatology WILEY

Combined microwaves and fractional microablative CO2 laser treatment for postpartum abdominal laxity

Paolo Bonan MD | Alice Verdelli MD

Background: Postpartum abdominal changes represent a major esthetic concern affecting women. As the abdomen stretches during pregnancy and some of the muscles lose tone, there is an increased skin laxity and a loss of abdominal elasticity. As a result, the abdomen becomes saggy.

Aims: To evaluate the performance of a combined microwaves and fractional microablative CO_2 laser treatment for reshaping and improvement of abdomen texture/laxity and striae distensae in postpartum women.

Patients/Methods: Fifteen women (median age 38 years) received three monthly abdomen treatments with a new microwaves platform, the ONDA Coolwaves® (DEKA) system, followed by a treatment with fractional microablative CO_2 laser (SmartXide2; DEKA) a month thereafter. We followed up each patient's weight and nutritional habits. Outcome was assessed using reproducible circumference and abdominal measurements, digital and 3D photography, the laxity score as well as patient satisfaction index.

Results: The overall mean circumferences reduction was 3.6 ± 1.2 cm. Significant improvement in skin laxity and tightening was noted by physicians and patients as well as a reduction of striae distensae. Interestingly, as a result of skin remodeling, repositioning of the umbilicus was also demonstrated. Treatments were well tolerated with no side effects.

Conclusions: Our data showed a sustainable reduction in circumference and improvement in appearance of abdomen in postpartum women, without compromising patients' safety.

Photobiomodulation, Photomedicine, and Laser Surgery
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Original Research

Combination of Fractional CO_2 Laser and Rhodamine-Intense Pulsed Light in Facial Rejuvenation: A Randomized Controlled Trial

Steven Paul Nistico, MD, PhD,[1] Martina Silvestri, MD,[1] Tiziano Zingoni, BSc,[2]
Federica Tamburi, MD,[1] Luigi Bennardo, MD,[1] and Giovanni Cannarozzo, MD[2]

Objective: This randomized controlled trial aims to verify the efficacy of a combined fractional CO2 laser and rhodamine-intense pulsed-light (r-IPL) protocol in the photoaging therapy.

Background: Skin aging is related to multiple environmental and genetic factors that give rise to different manifestations. In recent years many techniques have been proposed for the rejuvenation of the skin of the face such as ablative and nonablative procedures. Combination of laser or light sources with different wavelengths represents a safe and effective treatment method. R-IPL is a new pulsed-light technique capable to generate wavelengths varying from 550 to 650 nm proposed in nonablative photorejuvenation with a good efficacy and safety profile.

Methods: Twenty-two patients (skin phototypes II–III, aged 46–67 years) were randomly allocated into two groups: group A was treated only with a therapeutic standard dose of the fractional CO2 laser, whereas group B was treated with a combined therapy of r-IPL and fractional CO2 laser. All patients were treated up to three times at a 2-month interval. Efficacy of the procedures was assessed thanks to the Fitzpatrick Wrinkle Severity Scale (scores 1–9) before treatment and at a 4-month follow-up from the last treatment.

Results: Patients treated with the combination of r-IPL and fractional CO2 laser showed better results in terms of wrinkle reduction according to the Fitzpatrick Wrinkle Severity score (2.82 –0.87 vs. 3.09 –1.14), with a statistically significant reduction in healing times (7.82 –0.75 vs. 13.82 –1.94 days) and duration of post-treatment erythema (3.55 –0.93 vs. 8.18 –1.47 days). Patient satisfaction was higher after combined fractional CO2 laser and r-IPL treatment.

Conclusions: Our data suggest that combined use of fractional CO2 laser and r-IPL may lead to excellent results in terms of skin rejuvenation with a simple post-treatment management and an optimal tolerability.

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Original Research

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Steven Paul Nistico, MD, PhD,[1] Martina Silvestri, MD,[1] Tiziano Zingoni, BSc,[2]
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Patients were randomly allocated into 2 groups: group A (control) included 11 patients treated with the fractional CO2 laser alone (43.2 mJ/DOT—D-Pulse—500 lm DOT spacing; SmartXide, Deka Me.La, Italy) with a therapeutic standard dose according to recent reports.
Group B, on the contrary, included 11 patients treated with a combination of the fractional CO2 laser (22.5 mJ/DOT—D-Pulse—750 lm DOT spacing) used at a lower energy to reduce healing times and side effects, and the r-IPL (RightLight SynchroVasQ; Deka Me.La, Italy) with the following parameters: fluence of 15 J/cm2—8 +8 ms Delay 20 ms.

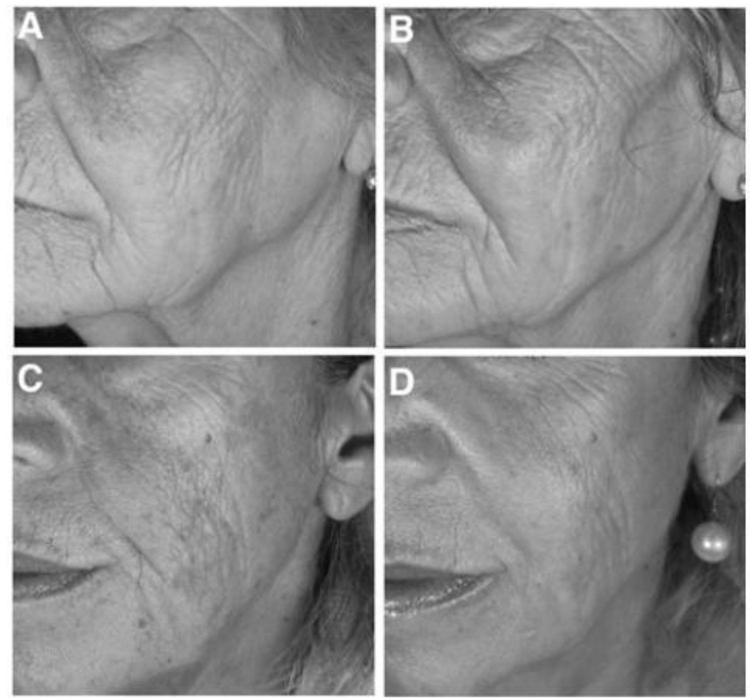

FIG. 1. Patient No. 6 left cheek before treatment (**A**) and 4 months after three fractional CO_2 laser treatments (**B**). Patient No. 17 left cheek before treatment (**C**) and 4 months after three fractional CO_2 laser and r-IPL treatments (**D**). r-IPL, rhodamine-intense pulsed light.

ORIGINAL ARTICLE

JCD Journal of Cosmetic Dermatology WILEY

Assessment of clinical efficacy of lidocaine/tetracaine 7%/7% peel cream in fractional microablative laser procedure-associated pain for facial skin aging treatment. A randomized, controlled, single-blind trial

Elisabetta Caprari MD[1] | Maria Teresa Viciguerra MD[1] | Massimo Milani MD[2]

Background: Lidocaine/tetracaine 7%/7% peel cream (L/T- pC) is very effective in reducing pain in several dermatological procedures, such as hair or tattoo laser removal or conventional photodynamic therapy associated pain. Fractional laser resurfacing (FLR) is an effective treatment strategy for facial skin aging. The main drawback of FLR is the procedure-associated pain. So far, no controlled data are available regarding the efficacy of L/T-pC in reducing pain during a full-facial microablative FLR session in subjects with facial skin aging.

Aim: To assess the clinical efficacy of L/T- pC in reducing pain during microablative FLR treatment in subjects with facial skin aging. We conducted a prospective, randomized, parallel- group, controlled, single- blind trial, performed in out- patients attending to a Laser Clinic for facial skin aging treatment.

Subjects and Methods: A total of 30 subjects (4 men, 26 women; mean age 42 ± 10 years; range 28–57) with mild to moderate facial skin aging (Glogau score ≥2), suitable for FLR treatment, were enrolled after their written informed consent. Participants were randomized to L/T- pC application (45 min before the laser treatment with the removal of the cream just before the starting of laser session) (n = 20) or to control (emollient cream; n = 10). FLR was performing using a fractional microablative CO_2 laser (Smartxide DOT 2 Deka) using a pulse power of 18 W (range 15–20) and pulse duration of 1.5 msec. The primary endpoint was the comparison of the mean visual analogue score (VAS) values between the two groups using a 10-cm scale (0 = no pain; 10: the most severe pain). The VAS score was measured just after the FLR session. Effective anesthesia (percentage of subjects with a VAS score ≤3) and the assessment of local tolerability and safety of the peel cream were the secondary trial endpoints.

Results: All the enrolled subjects concluded the trial. In the L/T- pC group, the VAS mean score was 3.0 ± 1.2. In the control group, the VAS mean score was 8.6 ± 0.5, representing a 65% reduction of the VAS score in the active treated group vs. controls. The difference between the two groups was statistically significant (p = 0.0001; Mann-Whitney test) with an absolute difference of −5 ± 0.4 cm; 95%CI of the difference: from −4.6 to −6.4 cm). Adequate anesthesia (VAS score≤3) was reported in 80% of subjects in the active group vs. 0% in the control arm. The cream was very well tolerated. One subject in the active group manifested moderate/severe edema in the cream application area, subsiding in 6 h. No other side effects were reported.

Conclusion: The application of L/T pC 7%/7% peel cream before a fractional laser resurfacing session significantly reduced the procedure-associated pain with good tolerability and safety profile.

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ORIGINAL CONTRIBUTION

JCD Journal of Cosmetic Dermatology WILEY

Combined microwaves and fractional microablative CO2 laser treatment for postpartum abdominal laxity

Paolo Bonan MD | Alice Verdelli MD

FIGURE 1 Abdomen pictures of a 36-y-old female patient before (A-C) and 8 weeks after (B-D) the combined microwaves and fractional microablative CO2 laser treatment

After enrollment, each patient underwent a monthly abdominal treatment with the ONDA Coolwaves® system (DEKA, Florence, Italy) for a total of three sessions (three-month treatment) followed by a treatment with fractional microablative CO2 laser (SmartXide2; DEKA) a month thereafter. Totally, patients underwent four treatments, one month apart.

…The employed fractional CO2 laser parameters were as follows: power 8 W, dwell time 700 µs, spacing 500 µm, Smart Stack 2, pulse mode: D-pulse (DP). Patients were treated with forced cold air to avoid pain. Immediately after the treatment, cold compresses and 1% hydrocortisone ointment were applied.

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ORIGINAL CONTRIBUTION

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Combined microwaves and fractional microablative CO2 laser treatment for postpartum abdominal laxity

Paolo Bonan MD | Alice Verdelli MD

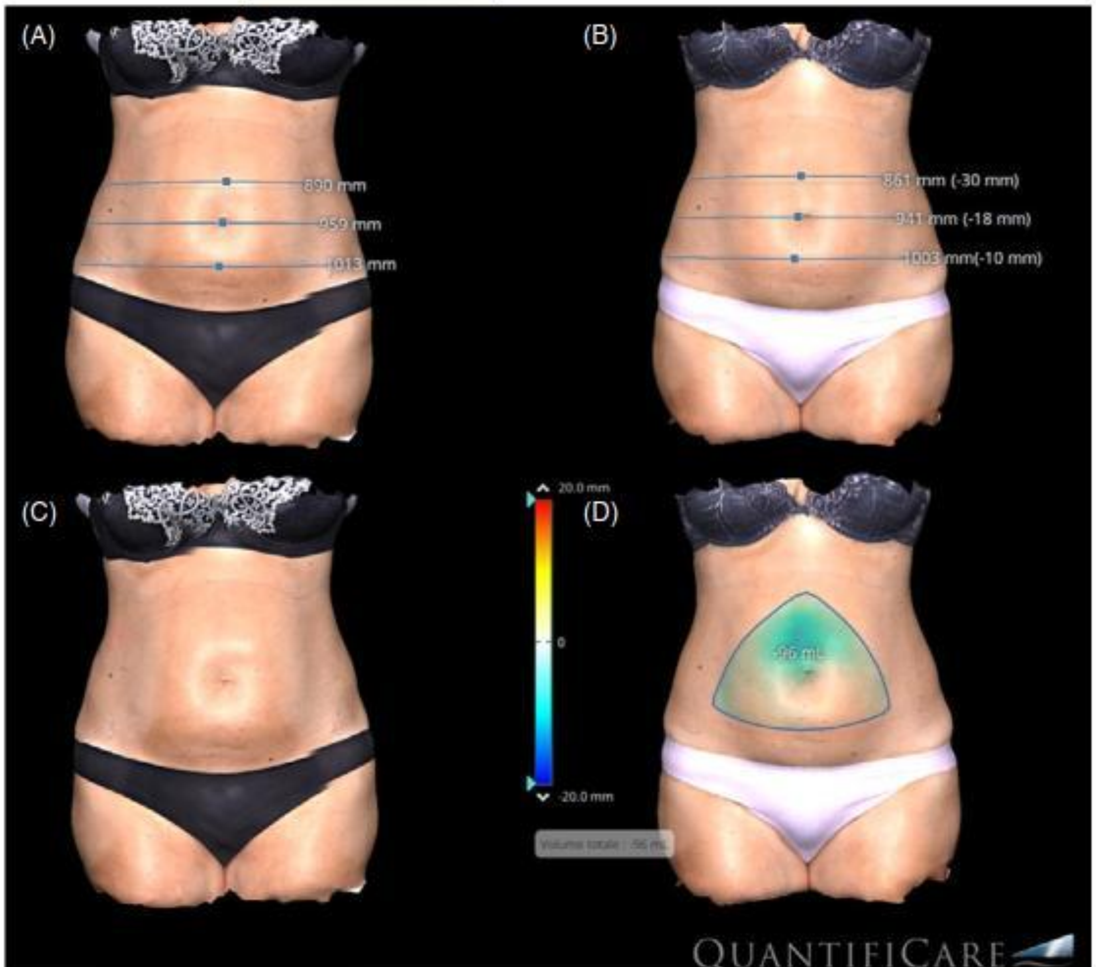

FIGURE 2 Abdomen 3D optical skin surface measurements performed before (A-C) and after (B-D) the combined microwaves and fractional microablative CO2 laser treatment. 3D images were captured with LifeViz® digital imaging system (QuantifiCare SA)

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Skin Rejuvenation

Poikiloderma of Civatte

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Treatment of Poikiloderma of Civatte With Ablative Fractional Laser Resurfacing: Prospective Study and Review of the Literature

Emily P. Tierney MD and C. William Hanke MD MPH
Laser and Skin Surgery Center of Indiana, Carmel, IN

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/telangiecatasia, 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/telangiecatasia, 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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Treatment of Poikiloderma of Civatte With Ablative Fractional Laser Resurfacing: Prospective Study and Review of the Literature

Emily P. Tierney MD and C. William Hanke MD MPH
Laser and Skin Surgery Center of Indiana, Carmel, IN

Figure: Pre (left) and Post (right) treatment of Poikiloderma of Civatte on a 54-year old Caucasian female at 2 months after 3 treatment sessions.

A bupivicane/lidocaine/tetracane topical local anesthetic mix was applied 30 minutes before treatment.

Treatment was administered to the neck and upper chest. CO2 laser parameters were: power 20 W, spacing 500 µm, dwell time 500 ms. Forced cold aier was administered during treatment for anesthesia.

Patients received a series of 1-3 treatment sessions, given at six-to-eight week intervals.

Treatment of Poikiloderma of Civatte With Ablative Fractional Laser Resurfacing: Prospective Study and Review of the Literature

Emily P. Tierney MD and C. William Hanke MD MPH
Laser and Skin Surgery Center of Indiana, Carmel, IN

Figure: pre(left) and post (right) treatment of Poikiloderma of Civatte ina 53-year old Caucasian female at 2 months after 1 treatment session

Figure: pre(left) and post (right) treatment of Poikiloderma of Civatte in a 57-year old Caucasian female at 2 months after 2 treatment sessions

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Scars

Histological Outcomes

Photobiomodulation, Photomedicine, and Laser Surgery
Volume 40, Number 6, 2022

Pp. 1–9
DOI: 10.1089/photob.2021.0165

Original Research

Skin Fractional Scar Treatment with a New Carbon Dioxide Scanner: Histological and Clinical Evaluation

Giuseppe Scarcella, MD,[1] Laura Pieri, PhD,[2] and Irene Fusco, PhD[3]

Background: The mechanism of action of fractional carbon dioxide (CO2) laser in the management of skin scarring is stimulation of collagen and fibroblasts in the dermis, resulting in remodeling and shrinking of the skin.

Objective: The purpose of this research is to assess the safety and performance of a new CO2 laser scanner for treatment of acne scars.

Methods: The study was carried out on 20 patients of both sexes, with a mean age of 25.7 –6.7 years. To assess the performance and safety of this new CO2 scanner, a preclinical histological evaluation was done. A clinical evaluation of acne scars was performed using Goodman and Baron's quantitative global acne scarring grading system (GBQGASGS) and a crusting scale where crusting scores ranged from 1 =none to 4 =severe. Digital photographs were taken to obtain esthetic results.

Results: GBQGASGS showed a significant improvement in patients' scars and the treatment was well tolerated, with no lasting side effects.

Conclusions: The new scanner seems to be an effective and safe device for skin scarring treatment, speeding up the healing time of scars.

Photobiomodulation, Photomedicine, and Laser Surgery
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Original Research

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Skin Fractional Scar Treatment with a New Carbon Dioxide Scanner: Histological and Clinical Evaluation

Giuseppe Scarcella, MD,[1] Laura Pieri, PhD,[2] and Irene Fusco, PhD[3]

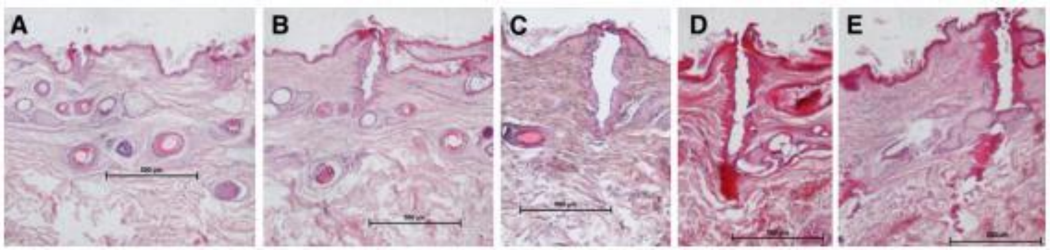

FIG. 3. Energy levels/DOT, 10–50 mJ (Group 1); changes in ablative, thermal, and total micron depths in ex vivo sheep skin after SCAR3 treatment (**A–E** scale bars 4×).

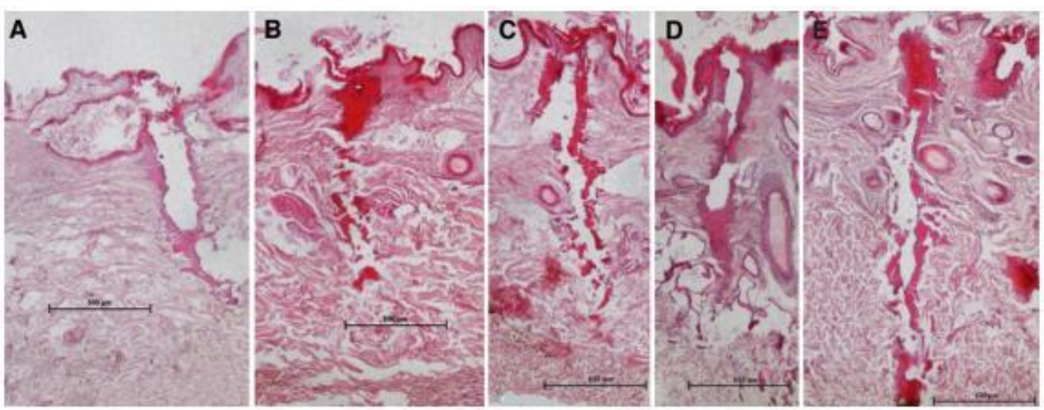

FIG. 4. Energy levels/DOT, 60–150 mJ (Group 2); changes in ablative, thermal, and total micron depths in ex vivo sheep skin after SCAR3 treatment (**A–E** scale bars 4×).

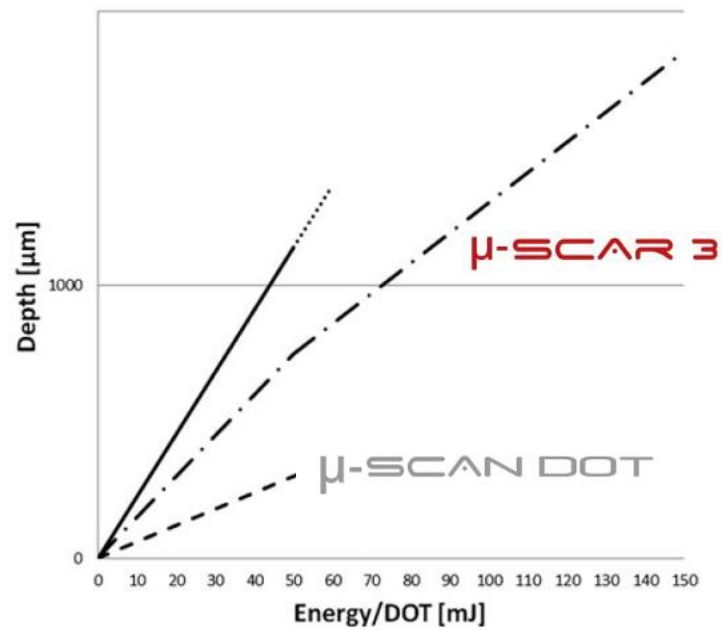

FIG. 2. Plot of the depth as energy increases: the thermal lesion depth achieved with SCAR3 (continuous line); ablation depth achieved with SCAR3 (dash–dot line); and ablation depth reported in literature data[40,45] with the HiScan DOT scanner (dashed line). DOT; SCAR3.

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Original Research

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Giuseppe Scarcella, MD,[1] Laura Pieri, PhD,[2] and Irene Fusco, PhD[3]

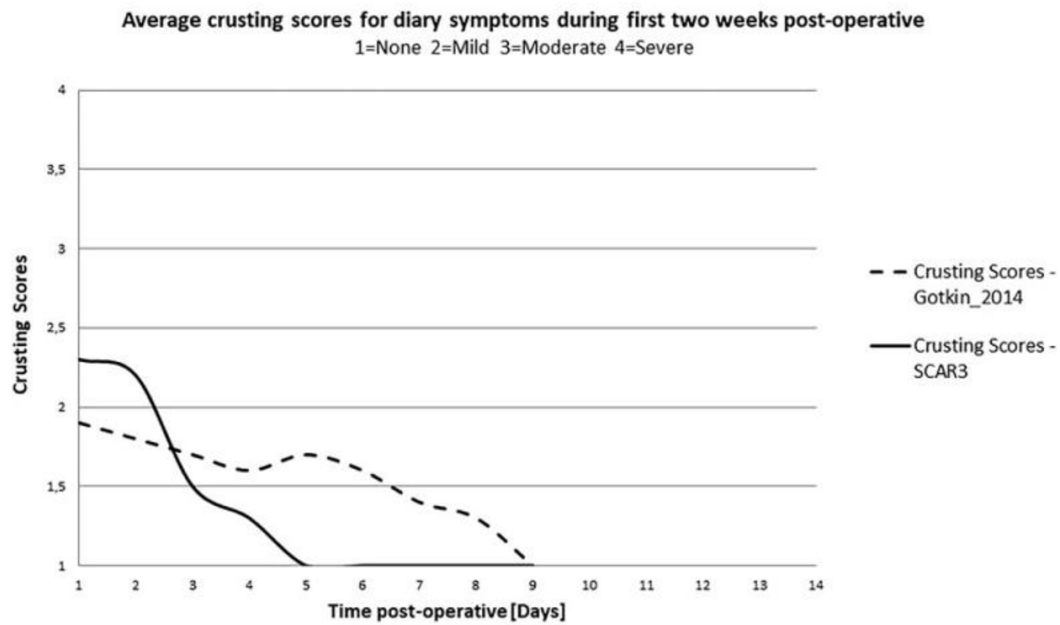

FIG. 5. Graphic representation of average crusting scores during the first 2 weeks postoperative, with the same energy/DOT.

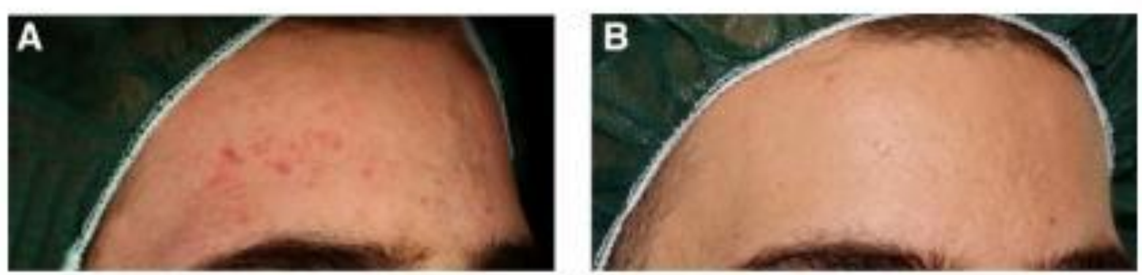

FIG. 6. View of patient's forehead at baseline **(A)** and 3-month follow-up **(B)**. An improvement in acne scars is observed.

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Communication

Ex Vivo Human Histology Fractional Treatment with a New CO_2 Scanner: A Potential Application on Deep Scarring

Paolo Bonan [1], Laura Pieri [2], Irene Fusco [2,*], Francesca Madeddu [2], Tiziano Zingoni [2], Claudio Conforti [3] and Domenico Piccolo [4]

Background and Objectives: For many years, fully ablative laser treatments, particularly those performed with a carbon dioxide (CO2) laser, were regarded as the gold standard for resurfacing. This study's goal is to assess the depth that can be reached by a new CO2 scanner system, through a skin model with greater dermal thickness, to use in the treatment of deep scarring.

Materials and Methods: Male human skin tissue was laser-treated using a CO2 fractional laser and a new scanning system, and all samples were fixed in 10% neutral buffered formalin, dehydrated using a series of crescent alcohol, embedded in paraffin, sectioned in series (4–5 μm thick), stained with haematoxylin and eosin (H&E), and then analysed under an optical microscope.

Results: From the epidermis through the underlying papillary and reticular dermis to various depths of the dermis, microablation columns of damage and coagulated microcolumns of collagen were observed. **The reticular dermis was fully penetrated up to 6 mm at higher energy levels (210 mJ/DOT), resulting in deeper tissue injury.** Although the laser might penetrate further, the skin stops there, leaving just the fat and muscular tissue.

Conclusions: The deep layers of the dermis can be penetrated by the CO2 laser system throughout the entire dermal thickness when using the new scanning system, suggesting that this laser's potential impact, at the selected settings, covers all skin targets required to perform superficial or deep treatments on any dermatological issue. Finally, patients who have problems, such as morbid scar-deep complications, which affect their quality of life, are more likely to profit from this innovative technique.

medicina MDPI

Communication

Ex Vivo Human Histology Fractional Treatment with a New CO_2 Scanner: A Potential Application on Deep Scarring

Paolo Bonan [1], Laura Pieri [2], Irene Fusco [2,*], Francesca Madeddu [2], Tiziano Zingoni [2], Claudio Conforti [3] and Domenico Piccolo [4]

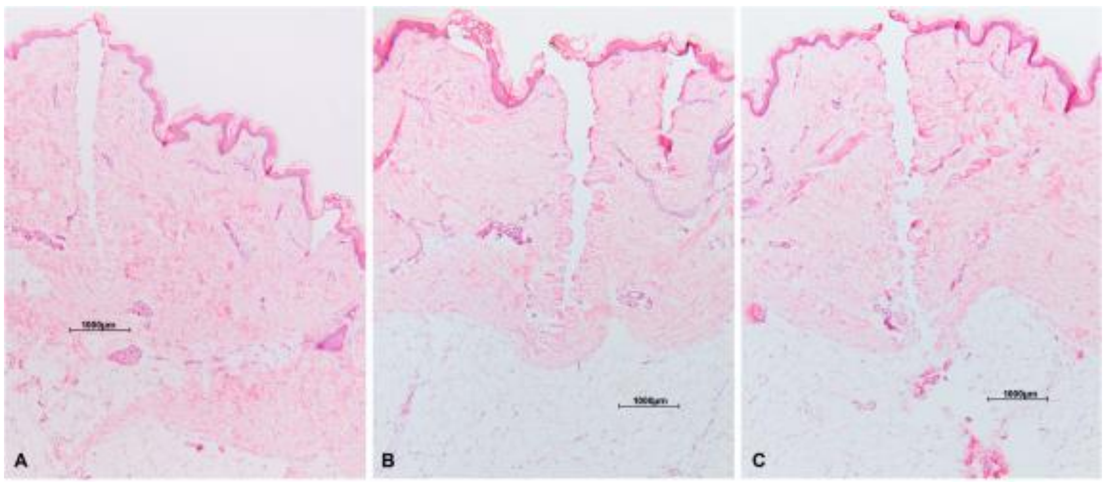

Fig A: Skin sample for Energies/DOT 140 mJ;
Maximum Ablation Depth: 3909 µm
Maximum Thermal Lesion Depth: 4318 µm

Fig. B: Skin sample for Energies/DOT 150 mJ;
Maximum Ablation Depth: 4136 µm
Maximum Thermal Lesion Depth: 4818 µm

Fig. C: Skin sample for Energies/DOT 210 mJ.
Maximum Ablation Depth: 5727 µm
Maximum Thermal Lesion Depth: 5954 µm

Changes in ablative, thermal, and total micron depths in ex vivo human skin after the SCAR3 treatment.

Up to 6 mm!

medicina MDPI

Communication

Ex Vivo Human Histology Fractional Treatment with a New CO_2 Scanner: A Potential Application on Deep Scarring

Paolo Bonan [1], Laura Pieri [2], Irene Fusco [2,*], Francesca Madeddu [2], Tiziano Zingoni [2], Claudio Conforti [3] and Domenico Piccolo [4]

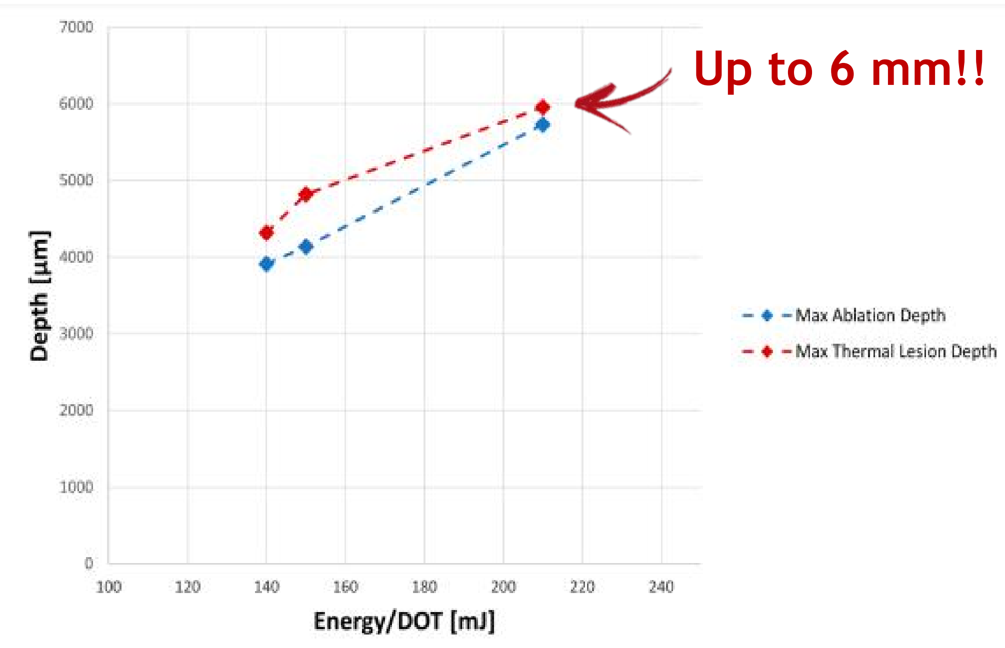

Figure: A plot of the depth as the energy increased: the curve with a red line is the Maximum Thermal Lesion Depth achieved with the SCAR3 scanner; the curve with a blue line is the Maximum Ablation Depth achieved with the SCAR3 scanner.

Deep scars require more ablation and therefore also more energy. The most severe scars require lasers with a depth of action >1 mm, and this can be achieved by increasing the ablative power, which is related to the energy delivered from the system. Since an increase in the depth of the action is directly related to the energy supplied, this consequently increases the risk of inflammation. This is why it was necessary to reduce the spot size of the DOT (columns of thermal harm).

From this perspective, **the new scanner SCAR3 was developed to obtain greater depths of ablation and, at the same time, reduce the amount of energy delivered to limit patient pain and the risk of occurrence of PIH.**

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Scars

Traumatic and Post-Surgical Scars

Clinical, Cosmetic and Investigational Dermatology
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ORIGINAL RESEARCH

Early fractional carbon dioxide laser intervention for postsurgical scars in skin of color

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A

B

Figure 3 A 47-year-old female patient with recent postsurgical scar (blepharoplasty), before (**A**) and 3 months after laser treatment (**B**).

- The **treatment areas were cleansed** by using a mild cleanser.
- A **topical anesthetic cream** was applied.
- After an hour of application, the **anesthetic cream was gently removed** to obtain a completely dry skin surface.
- Scarring sites were treated with **fractional CO_2 laser** using a power of 10-15W according to the skin type, dwell time of 500 µs, Stack 2 and 700 µm spacing.
- **Topical antibiotic cream** was applied twice per day for 3 days following teh session. Patients were instructed to use a **full-spectrum sunscreen** regularly.

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ORIGINAL RESEARCH

Early fractional carbon dioxide laser intervention for postsurgical scars in skin of color

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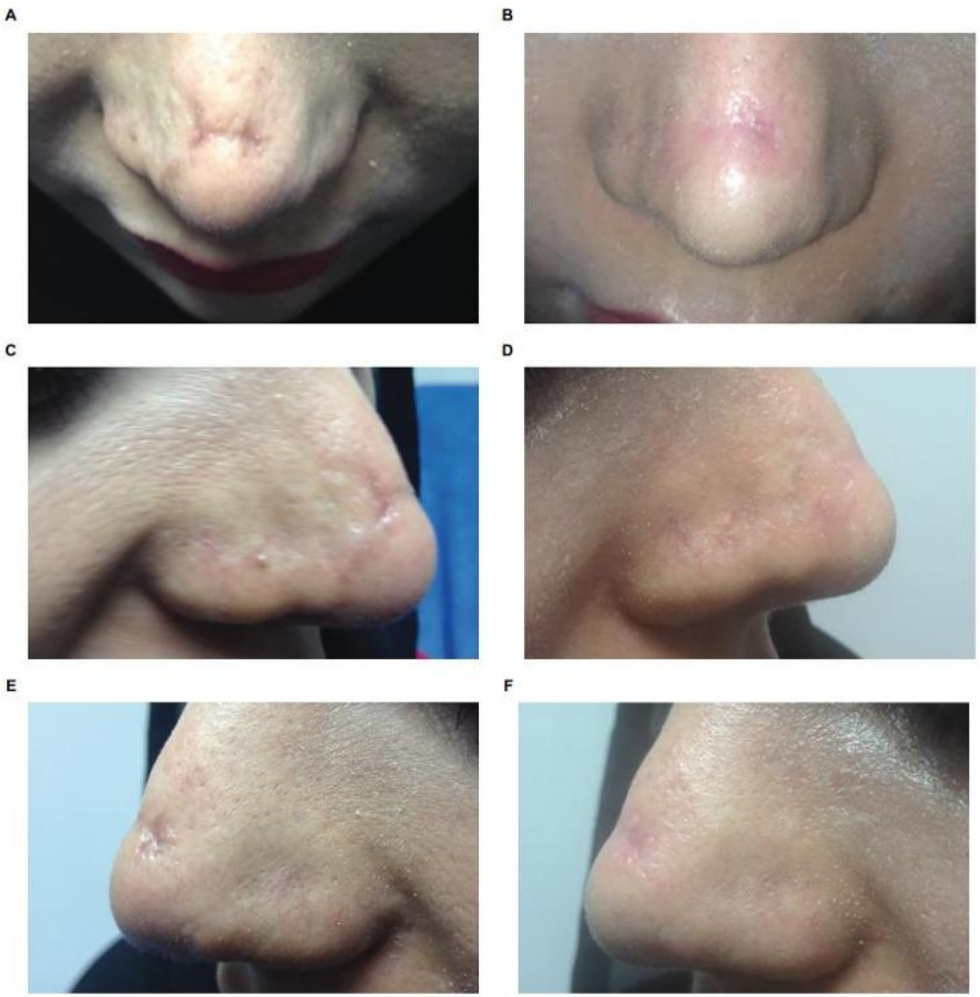

Figure 2 A 29-year-old female patient with recent postsurgical scar (rhinoplasty), before laser treatment (**A**, **C**, **E**) and 3 months after laser treatment (**B**, **D**, **F**).

- The **treatment areas were cleansed** by using a mild cleanser.
- A **topical anesthetic cream** was applied.
- After an hour of application, the **anesthetic cream was gently removed** to obtain a completely dry skin surface.
- Scarring sites were treated with **fractional CO_2 laser** using a power of 10-15W according to the skin type, dwell time of 500 µs, Stack 2 and 700 µm spacing.
- **Topical antibiotic cream** was applied twice per day for 3 days following teh session. Patients were instructed to use a **full-spectrum sunscreen** regularly.

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Remodelación con láser de cicatrices hipertróficas y queloideas: estudio prospectivo en 30 pacientes

Laser remodelling of hypertrophic and keloid scars: prospective study in 30 patients

Rivera-Secchi, K.*, Acosta, G.**, Vélez, M.***, Trelles, M.A.****

The use of lasers in the treatment of hypertrophic scars and keloids has shown acceptable outcomes. The aim of this study is to analyze and determine the efficacy and safety of a combination of two lasers in the management of hypertrophic and keloid scars of any etiology. This is a prospective and descriptive study conducted between January 2011 and June 2013 in which 40 scars on 30 patients phototype III to VI were treated. The Vancouver Scar Scale (VSS) and the Patient and Observer Scar Assessment Scale (POSAS) were used to evaluate the results. In the first phase of treatment a non-ablative Nd: YAG 1064 nm laser for a total of 6 sessions was used. Following, 4 to 7 sessions of CO2 fractional laser, at 20W were given. Patients were evaluated 6 months after last treatment.

After analyzing the results, there was an improvement in all variables. The parameters that showed better outcome were the vascularization and skin pliability. Pruritus was the symptom with best remission. Functional limitation generated by scars located on anatomical areas with mobility was recovered in 80% in the best case.

Laser scar remodelling can be considered an alternative for hypertrophic scars and keloids of any etiology using appropriate parameters in relation to each case

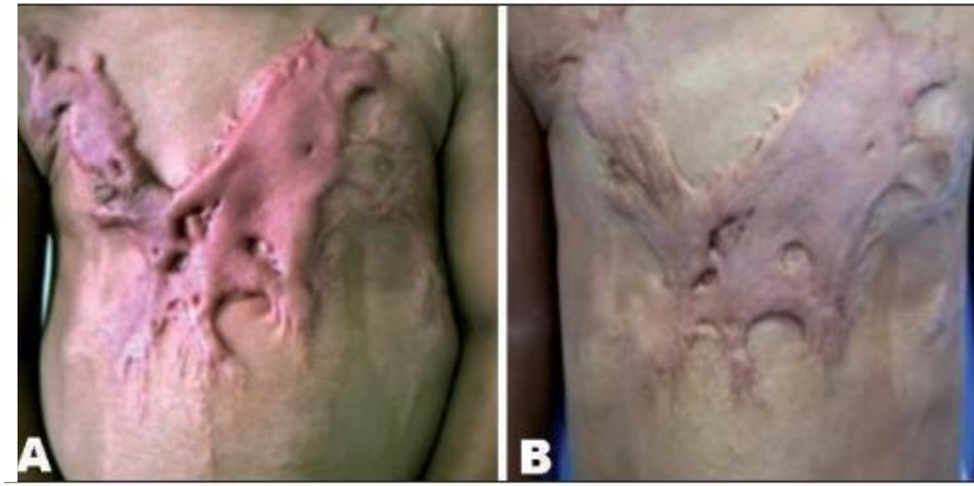

Fig. 3 A) Varón de 3 años de edad con cicatriz queloidea en tórax anterior y limitación para la inspiración profunda y la movilización; prurito intenso. B) Control 6 meses después del último tratamiento con 4 sesiones de CO^2 fraccionado. Mejoría evidente.

Fig. 4 A) Varón de 3 años de edad. Cicatriz postquemadura de 4 meses de antigüedad con limitación funcional para la movilización del cuello y la elevación de ambos miembros superiores. B) Mejoría después del tratamiento con 6 sesiones de láser Nd: YAG y CO^2. C) Obsérvese la remodelación de la retracción, de la brida cicatricial y la consecuente mejoría de la postura en el control a los 6 meses del último tratamiento.

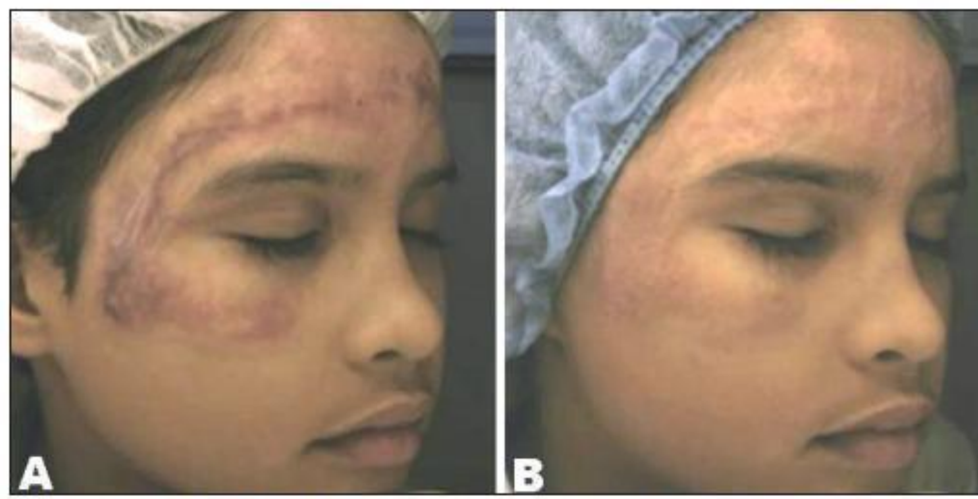

Fig. 5 A) Tratamiento láser en varón de 7 años de edad con cicatriz postquemadura al que se realizaron 4 sesiones de CO^2. B) Resultados en el control a los 6 meses del último tratamiento.

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Remodelación con láser de cicatrices hipertróficas y queloideas: estudio prospectivo en 30 pacientes

Laser remodelling of hypertrophic and keloid scars: prospective study in 30 patients

Rivera-Secchi, K.*, Acosta, G.**, Vélez, M.***, Trelles, M.A.****

Fig. 9 A) Antes del tratamiento láser en cicatriz postquemadura en varón de 7 años de edad. B) Tras 6 sesiones de Nd: YAG y 7 sesiones con CO^2 se observó marcada mejoría sintomática del prurito y del dolor. Aspecto a los 6 meses del último tratamiento.

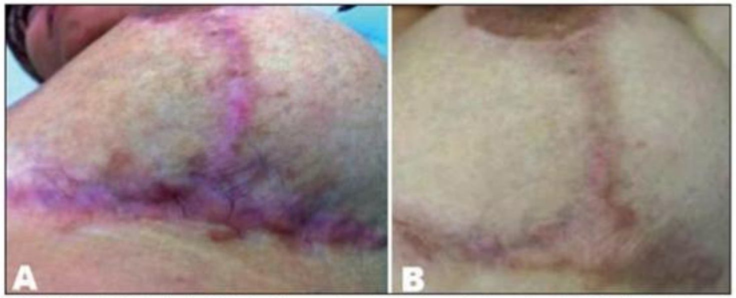

Fig. 9 A) Mujer de 34 años de edad. Cicatriz de 7 meses de antigüedad secundaria a mastopexia B) Resultados tras la aplicación de la primera fase de tratamiento con láser de Nd: YAG de 1064 nm.

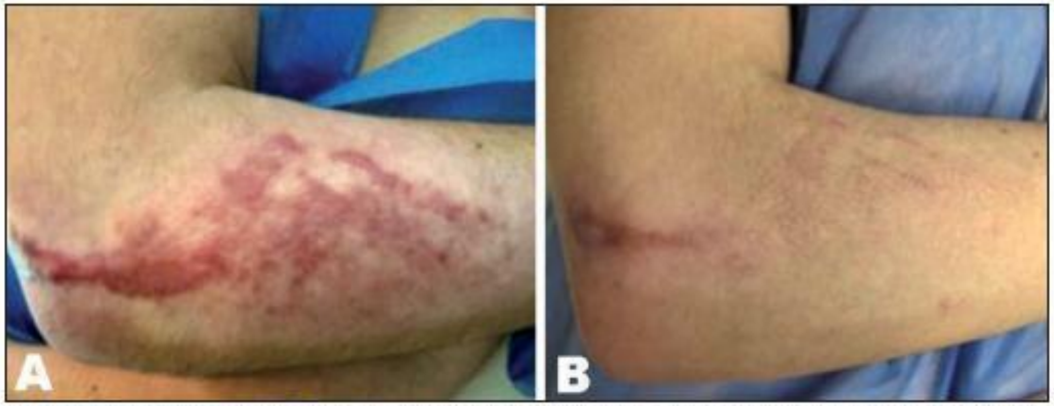

Fig. 6 A) Mujer de 28 años de edad con cicatriz postquemadura. B) Resultados tras 6 sesiones de Nd: YAG y 3 de CO^2, a los 6 meses del último tratamiento.

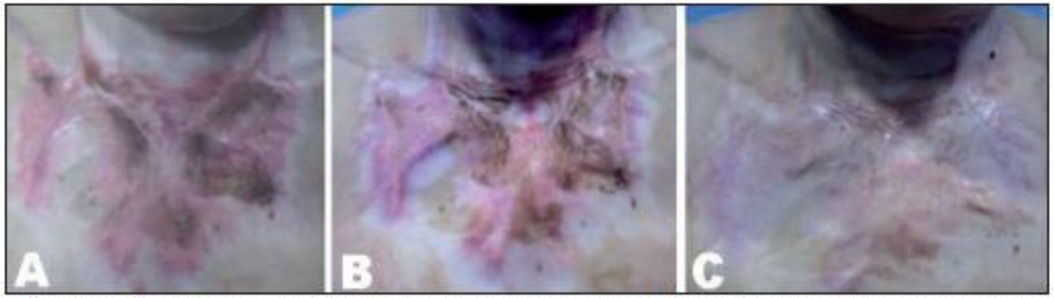

Fig. 7 A) Varón de 7 años de edad con cicatriz retráctil en cara anterior del tórax por quemadura. B) Evolución estética y funcional satisfactoria tras 6 sesiones de Nd: YAG y 4 de CO^2. C) Control a los 6 meses del último tratamiento.

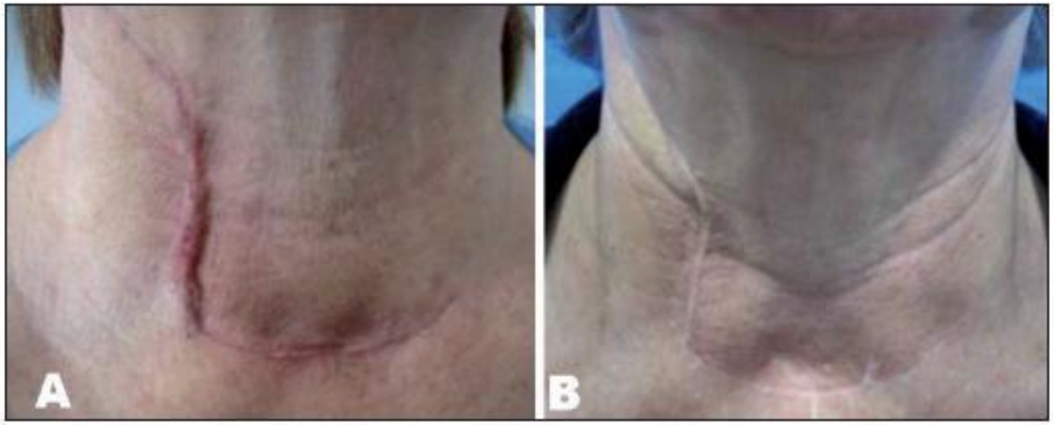

Fig. 8 A) Cicatriz postoperatoria secundaria a cervicotomía exploratoria en mujer de 63 años de edad. B) Resultado en el control a los 6 meses del último tratamiento.

Efficacy of Fractionated CO_2 Laser and Pulsed Dye Laser in Treatment of Keloids and Hypertrophic Scars

Bonan P.[1], Shokeir H.A.[2], Emam H.M.[3], Samy N.A.[2], Rabie A.A.[3] and Abdelhamid M.F.[3]

[1]Department of Dermatology II, University of Florence, Florence, Italy
[2]Department of Medical Laser Applications, Dermatology Unit, National Institute of Laser Enhanced Sciences, Cairo University, Egypt.
[3]Research Department of Dermatology and Venereology, National Research Center, Cairo, Egypt.

Introduction: Keloids and hypertrophic scars are skin proliferative disorders with altered dermal matrix deposition. Although laser improves scars, a universal treatment protocol regarding laser type, dosage and number of sessions has not yet been established; in addition Laser indications and efficacy have not been fully defined. We studied the impact of laser therapies on keloids and hypertrophic scars.

Methods: This study aimed to assess keloids and hypertrophic scars response to 6 sessions of combined pulsed dye laser and fractionated CO2 laser (4 sessions of pulsed dye laser and 2 sessions of fractionated CO2 laser). Pulsed Dye laser parameters were fluence: 6- 6.5 joules/cm2, spot size: 10 millimeter and pulse duration: 0.5 millisecond. Fractionated CO2 laser parameters were fluence: 15 Watts, spacing: 500 micrometer and dwell time: 0.7-1 millisecond. Scar textural pliability, pigmentation and vascularity were subjectively scored according to the modified Vancouver Scar Scale comparing readings before laser sessions and after the 2nd, 4th, 6th laser sessions and after follow up for 6 months. Collected data was analyzed with appropriate statistical tests. Hemoglobin, melanin and contour indices were objectively calculated.

Results: Combined pulsed dye laser and fractionated CO2 laser ameliorated (with highly statistically significance) modified Vancouver Scar Scale from 7.00 ± 0.60 to 2.00 ± 1.35 in keloids and from 7.13 ± 0.99 to 1.63 ± 0.74 in hypertrophic scars. Hemoglobin, melanin and contour indices showed amelioration with combined pulsed dye laser and fractionated CO2 laser.

Conclusion: When pulsed dye laser is associated with fractionated CO2 laser in the treatment of keloids and hypertrophic scars, scar amelioration is achievable.

Efficacy of Fractionated CO_2 Laser and Pulsed Dye Laser in Treatment of Keloids and Hypertrophic Scars

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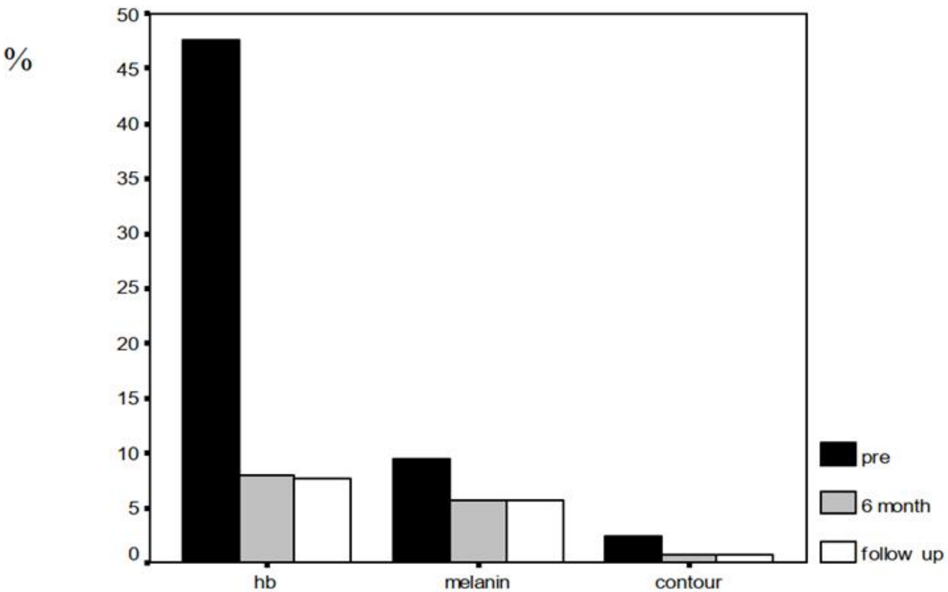
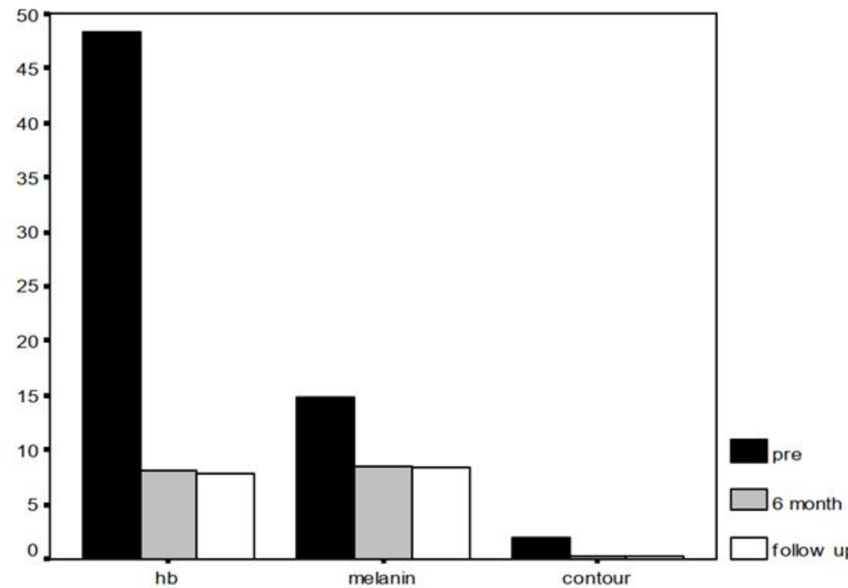


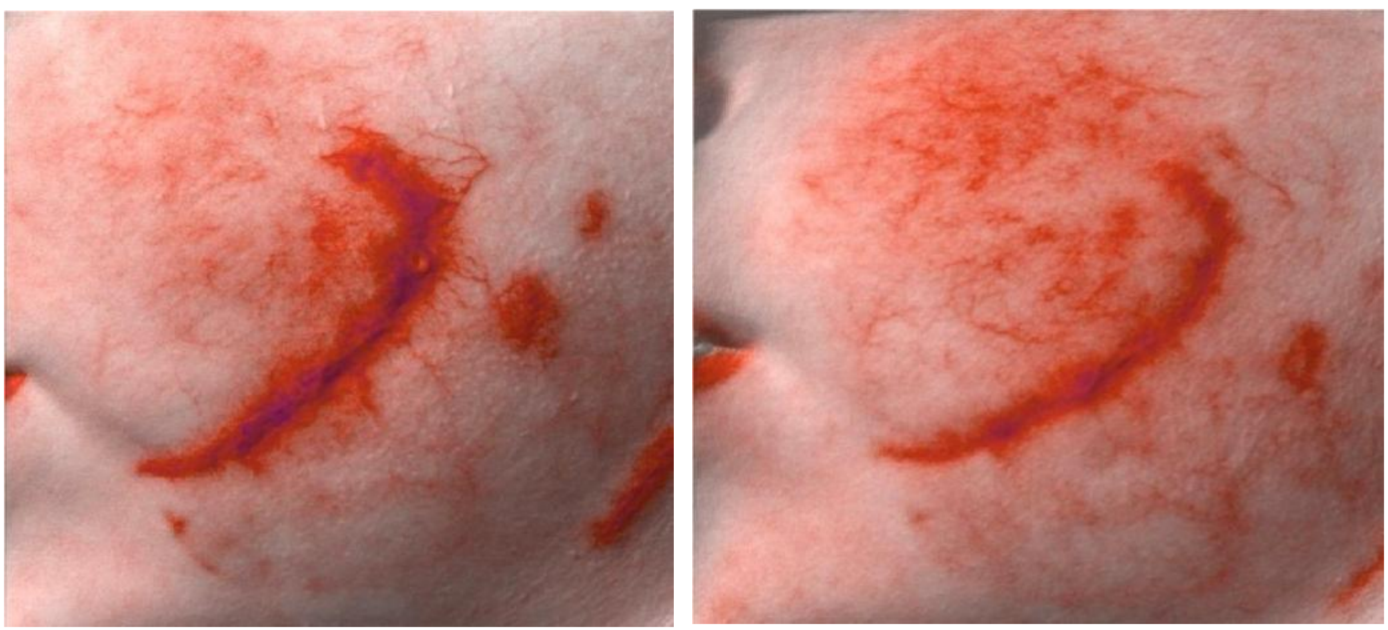
Hemoglobin (hb), melanin and contour of ***keloids*** pre, post 6 sessions of combined **pulsed dye laser** and **fractionated CO2** laser and after follow up of 6 months.



Hemoglobin (hb), melanin and contour of ***hypertrophic scars*** pre, post 6 sessions of combined **pulsed dye laser** and **fractionated CO2** laser and after follow up of 6 months.

Left shoulder ***keloid*** before (a), after (b) 6 sessions of combined pulsed dye laser and fractionated CO_2 laser and after follow up of 6 months (c).

Right cheek and upper lip hypertrophic scar before (a) and after (b) 6 sessions of fractionated CO2 laser.



Cutaneous MultiSpectral Analyzator image for left cheek hypertrophic scar before (a) and after (b) combined pulsed dye and fractionated CO2 laser treatment showing a decrease in the hemoglobin amount.

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ORIGINAL PAPERS

Successful treatment of traumatic scars with combined nonablative fractional laser and pinpoint technique of standard CO_2 laser

Shady M. Ibrahim*, Mohamed L. Elsaie[†,‡],
Mohamed Ismail Kamel*, & Essam-Eldin Mohammed[§]

To evaluate the use of a pinpoint irradiation technique followed by nonablative fractional technique in treatment of traumatic scars. Thirteen patients with traumatic scars were treated with pinpoint technique of CO2 laser using traditional handpiece activating laser at a frequency (50 Hz) to deliver pulsed mode with power of 1 W using the focusing technique followed by 3-5 passes of the nonablative 1540 nm fractional Er:glass laser. An independent physician evaluator assessed the treatment outcomes using Vancouver scar scale (VSS) and 5-point grading scale (grade 0, no improvement; grade 1, 1-25%; grade 2, 26-50%; grade 3, 51-75%; grade 4, 76-100% improvement). After the final treatment, average percentage changes of VSS were 41.5%. Improvement was evident in terms of vascularity, pigmentation, and height, while insignificant in terms of Pliability. Based on physician's global assessment, mean grade of 2.5 was achieved. Patient's subjective satisfaction scores paralleled the physician's objective evaluation. Pinpoint irradiation technique by CO2 laser followed by nonablative fractional laser is a safe and effective modality in treatment of scars.

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Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Scars

Burn Scars

Lasers in Medical Science (2023) 38:144
https://doi.org/10.1007/s10103-023-03814-1

BRIEF REPORT

An audit of the use of fractional CO2 laser for hypertrophic burn scars: a real-life perspective

Elizabeth Wasson[1] · Charankumal Thandi[2] · Emma Hitchens[2] · Kay Thomas[2] · Daniel Keith[2]

The CO2 laser (10,600 nm, SmartXide Touch, DEKA, Florence, Italy) was used in its fractional mode using the following settings: Power 10W, Emission Mode HP, 2 Stacks, Spacing 500 µm for all patients.
A single pass was carried out under topical anaesthetic for all but one patient who required a general anaesthetic.
Treatments were repeated at 3–6-month intervals.

Figure 2 a) Hypertrophic burn scar on the neck of patient G before CO2 laser therapy. **b)** Scar at 3 months following CO2 laser therapy. Smoothing of the irregular texture/relief of scar and improved pliability with greater range of movement.

ORIGINAL RESEARCH

Efficacy of Fractional Carbon Dioxide Laser in the Treatment of Mature Burn Scars: A Clinical, Histopathological, and Histochemical Study

by KHALED EL-HOSHY, MD, FAAD; MONA R. E. ABDEL-HALIM, MD; DINA DORGHAM, MD; SAFINAZ SALAH EL-DIN SAYED, MD; and MONA EL-KALIOBY, MSc

OBJECTIVE: The purpose of this study was to evaluate the efficacy of fractional carbon dioxide laser use in the treatment of mature burn scars.

DESIGN: This was an uncontrolled, open-label clinical trial.

SETTING: The setting for this study was Dermatology Department at Cairo University in Cairo, Egypt.

PARTICIPANTS: Twenty patients with mature burn scars were included in the study.

MEASUREMENTS: Three fractional carbon dioxide laser sessions were given, 4 to 8 weeks apart. Primary outcome was measured using two scar scales, the Vancouver Scar Scale and the Patient and Observer Scar Assessment Scale. Secondary outcomes included evaluation of collagen and elastic fibers using routine hematoxylin and eosin, Masson's trichrome, and orcein stains. Outcomes were measured two months after the last laser session.

RESULTS: Both Vancouver Scar Scale and Patient and Observer Scar Assessment Scale showed significant reduction following treatment ($p<0.001$). Scar relief and pliability improved most followed by vascularity. Pigmentation improved the least. Percent improvement in Patient and Observer Scar Assessment Scale patients' overall assessment was 44.44 percent. The pattern and arrangement of collagen and elastic fibers showed significant improvement ($p<0.001$, $p=0.001$, respectively), together with significant improvement in their amounts ($p=0.020$, $p<0.001$, respectively). No significant correlation existed between clinical and histopathological/histochemical scores. Side effects and complications were mild and tolerable.

CONCLUSION: Fractional carbon dioxide laser use is an effective and safe method for treating burn scars with a significant change in the opinion of the patients about their scar appearance.

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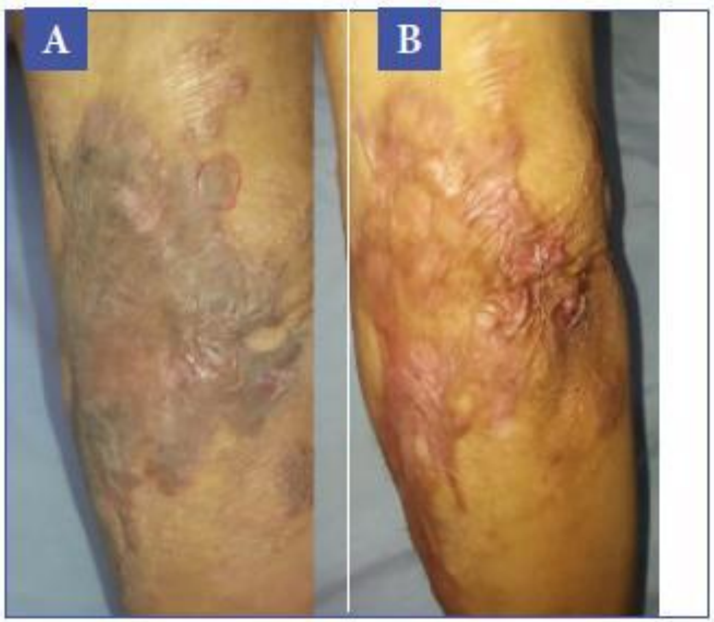

FIGURE 3. Demonstration of clinical response, before treatment (A) and after treatment (B)—The patient showed a 31% improvement in VSS and a 40 percent improvement in total POSAS, with relief being the most improved parameter.

- **Topical anesthesia** was applied 30 to 60 minutes before the procedure.

- The scars underwent three treatment sessions using a **fractional CO_2 laser** sessions performed 4 to 8 weeks apart.

  The following parameters were used in a single pass:
  Power 18W
  HP Pulse
  Dwell Time 600 µs
  SmartStack 3
  Spacing 200 µm

- Post-laser home treatment included **topical application of panthenol 2%** twice daily for four weeks. Patients were also instructed to use **sunscreen** regularly and **to avoid removal of the crust**.

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The **Vancouver Scar Scale (VSS)** was used for measuring primary outcome. It was calculated at baseline and two months after the last laser treatment.

The percentage improvement in each variable of VSS is listed in Table 6, with pliability being the most significantly improved item.

TABLE 6. Percentage improvement in each variable in Vancouver Scar Scale (VSS)

VARIABLE	RANGE	MEAN±SD
Pigmentation	0.0–0.0	0.00±0.00
Vascularity	-(50.0)–100.0	39.21±46.00
Pliability	0–100.0	53.43±22.26
Height	0–100.0	29.4±30.92
p value*	< 0.0001	

TABLE 4. Results of VSS, total POSAS, and POSAS patients' overall assessment before and after treatment

SCALE	RANGE	MEAN±SD
Vancouver Scar Scale VSS		
Before treatment	5–11	7.76±2.07
After treatment	2.5–7	5.18±1.18
P value*	<0.001	
Total POSAS		
Before treatment	51–87	65.71±11.23
After treatment	26–56	38.35±9.92
P value*	<0.001	
POSAS patient overall assessment		
Before treatment	6–10	3–7
After treatment	9.12 ± 1.26	5.12±1.16
P value*	<0.001	

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TABLE 7. Percentage improvement in each variable in Patient and Observer Scar Assessment Scale Observer Scale

VARIABLE	RANGE	MEAN±SD
Vascularity	-(50.0)–80.0	38.25±31.43
Pigmentation	-(10.0)–66.7	37.07±19.81
Thickness	10.0–66.7	47.42 ± 14.66
Relief	21.4–66.7	53.43±11.18
Pliability	33.3–78.6	49.06±13.99
p value*	0.0071	

SD: standard deviation
*p value significant if <0.05

The **Patient and Observer Scar Assessment Scale (POSAS)** was used for measuring primary outcome. It was calculated at baseline and two months after the last laser treatment. Each participating subject completed the patient's portion of the POSAS. Patient overall assessment scores on a scale from 1 to 10 were also calculated.

The percentage improvement in each variable of the POSAS is listed in Table 7, with **relief** being the most significantly improved item.

Scar duration negatively influenced the percentage improvement in VSS, but not the percentage improvement in **total POSAS**.

TABLE 4. Results of VSS, total POSAS, and POSAS patients' overall assessment before and after treatment

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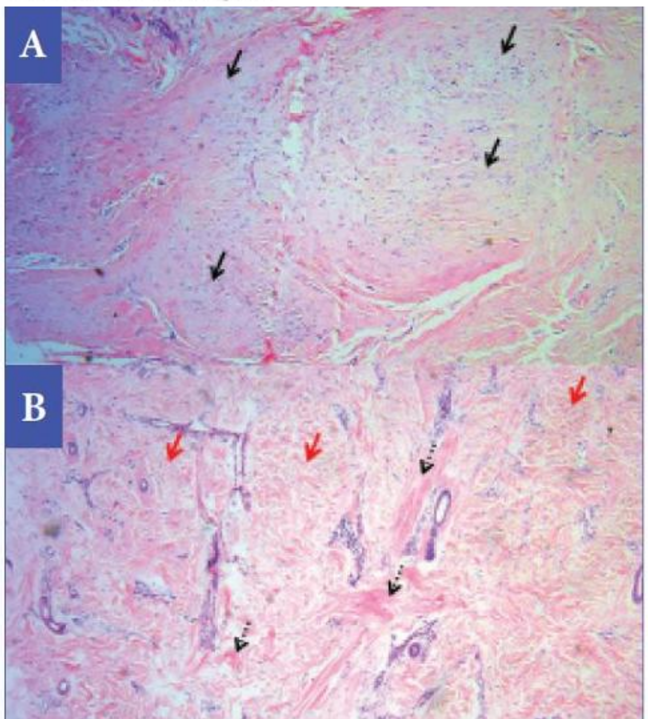

FIGURE 4. Photomicrographs demonstrating histopathological grading of collagen fibers using routine H&E stain, before treatment (A) and after treatment (B)—The thick sclerotic collagen bundles (solid black arrows) in the scar tissue before treatment (Grade 5) changed to a combination of fibrotic (dotted black arrows) and fibrillar (red arrows) collagen, with vessels starting to appear in the scar tissue perpendicular to the epidermis after treatment (grade 2) (H&E staining original magnification x 40).

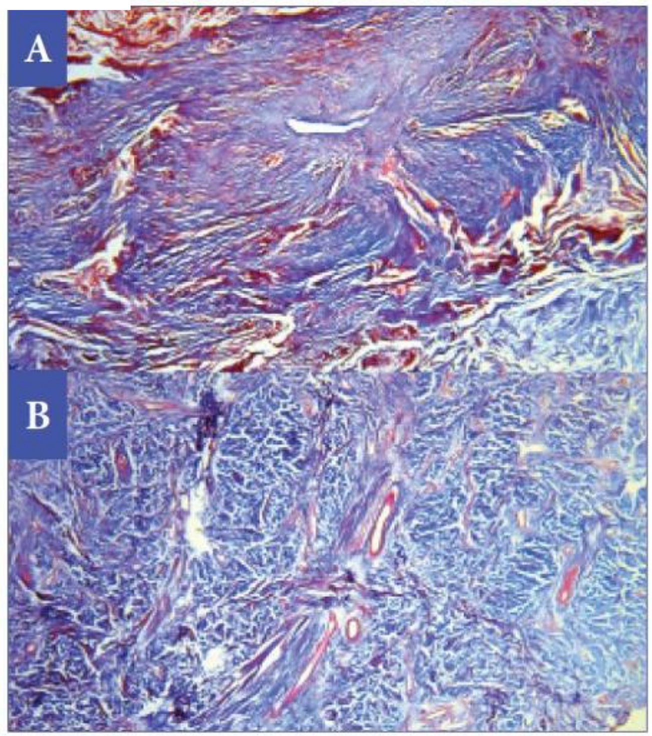

FIGURE 5. Photomicrographs representing results of Masson's trichrome staining for collagen fibers for the same case presented in Figure 4, before treatment (A) and after treatment (B)—Reduction in collagen density (16% by image analysis) and improved collagen quality. (Masson's trichrome stain, original magnification x 40).

TABLE 8. Comparison of H&E grading score and mean area percent of collagen (Masson's trichrome) before and after treatment

STAIN	RANGE	MEAN±SD
H&E grading score of collagen fibers		
Before treatment	2–5	4.12±0.78
After treatment	2–4	2.71±0.92
p value*	< 0.001	
Mean area % of collagen (Masson's trichrome)		
Before treatment	6.44–35.19	18.69±7.70
After treatment	2.62–21.64	11.52±6.16
p value*	0.020	

H&E: haemotoxylin and eosin; SD: standard deviation
*p value significant if <0.05.

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Scars

Acne Scars

REDUCING RECOVERY TIME WHILE INCREASING PROFILE IMPROVEMENT: A NOVEL DEEP PULSE FRACTIONAL CO_2 LASER COMBINED WITH A RADIO-FREQUENCY SYSTEM

Redução do Período de Recuperação e Melhora de Resultados Utilizando um Novo Laser Fracionado de Co_2 com Radio-frequencia

[1] Department of Dermatological Sciences.
[2] Photobiolab Research Unit University of Florence.

P. Bonan[1]
G. Cannarozzo[1]
M. Troiano[1]
C. Morini[1]
D. Fortuna[2]
P. Campolmi[1]

Minimally ablative or sub-ablative lasers, such as fractional CO2 lasers, have been developed in an attempt to achieve the clinical results observed with traditional ablative lasers but with minimal side effects. Despite being an ablative this fractional delivery system is able to produce a fractional ablation of the tissye through the development of microscopic vertical columns surronded by spared areas of epidermis and dermis, ensures rapid wound healing and minimum downtime. The new PSD (Pulse Shape Design) technology allow for selecting different pulse waveforms in order to meet the need of all skin conditions, each optimized and adapted for corrrect use with cold superficial fine ablation, minimally deeper thermal ablation or more volumetric thermal ablation. With this system, the deep ablation and thermal stimulation help reduce superficial erythema and oedema, lowering the operating and post-operative pain levels and preserving the therapeutic effects in the reticular derma, thus producing rapid and high-quality results. The simultaneous snchronized delivery of a RF current to the deeper layer of the skin competes the therapeutic scenario, ensuring an effective skin tightening effect over the entire area treated. We describe the preliminary results observed in the treatment of wrinkles and acne scars using this new laser technology.

REDUCING RECOVERY TIME WHILE INCREASING PROFILE IMPROVEMENT: A NOVEL DEEP PULSE FRACTIONAL CO_2 LASER COMBINED WITH A RADIO-FREQUENCY SYSTEM

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Figure 3 - A-B) Ice-peak acne scars before and after the treatment (FCO2/RF: 10 watts, Dpulse, Stack 3, Dwell-Time 600 μsec, Space 800 μm; RF: 3 W, 2 sec).

ORIGINAL ARTICLE

Preliminary Comparison of Fractional Laser with Fractional Laser Plus Radiofrequency for the Treatment of Acne Scars and Photoaging

NORMA CAMELI, PHD, MD, MARIA MARIANO, MD, MIRKO SERIO, MD, AND MARCO ARDIGÒ, MD*

Background: The therapeutic approach to the treatment of acne scars and photoaging varies according to the type of lesion. Traditional carbon dioxide (CO2) laser is associated with long healing times, persistent erythema, and high risk of post-inflammatory hyperpigmentation. Fractional laser technology, which involves the application of microscopic beams of pixilated light inducing focal zones of tissue injury surrounded by normal tissue, is currently used for the treatment of acne scars and photoaging.

Objective: To compare the results obtained using CO2 fractional laser with those obtained using CO2 fractional laser plus radiofrequency for the treatment of atrophic acne scars and photoaging by means of clinical evaluation and confocal laser.

Materials and methods: Ten patients with photoaging and acne scars underwent a single treatment using both technologies. Investigators and patients evaluated the clinical effect of the treatments using digital photographs, dermatoscopy, and in vivo reflectance confocal microscopy before and immediately, 1 week, and 3 months after treatment.

Results and conclusion: Our results underlined the high efficacy of combining CO2 laser and radiofrequency, producing better results with fewer sessions, lower risks, and fewer side effects.

Preliminary Comparison of Fractional Laser with Fractional Laser Plus Radiofrequency for the Treatment of Acne Scars and Photoaging

Norma Cameli, PhD, MD, Maria Mariano, MD, Mirko Serio, MD, and Marco Ardigò, MD*

Figure 1. Acne scars in a 36-year-old woman (A) before and (B) after carbon dioxide (CO_2) laser treatment plus radiofrequency.

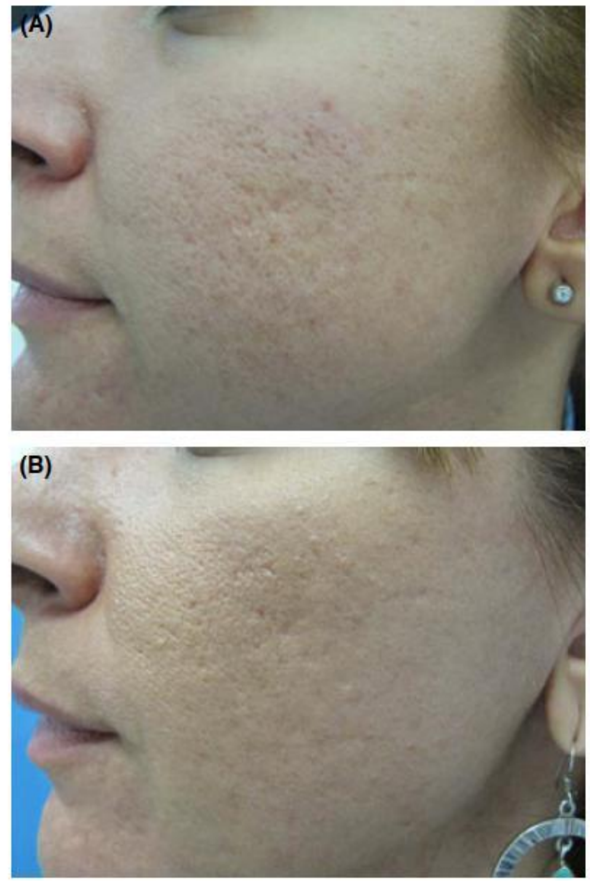

Figure 3. (A) Acne scars in a 36-year-old woman (A) before and (B) after treatment with carbon dioxide (CO_2) laser alone.

Preliminary Comparison of Fractional Laser with Fractional Laser Plus Radiofrequency for the Treatment of Acne Scars and Photoaging

Norma Cameli, PhD, MD, Maria Mariano, MD, Mirko Serio, MD, and Marco Ardigò, MD*

Figure 9. Dermatoscopy of acne scars before treatment.

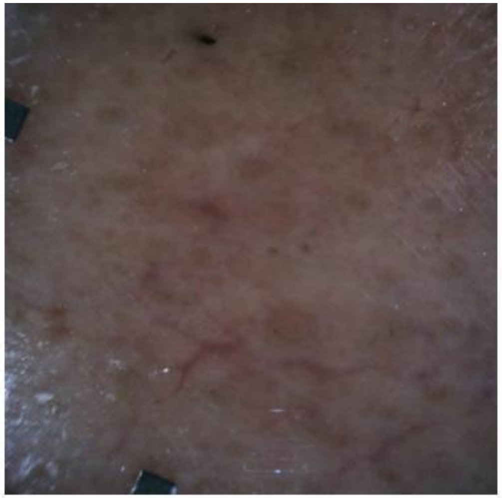

Figure 10. Dermatoscopy of acne scars after treatment with carbon dioxide laser plus radiofrequency.

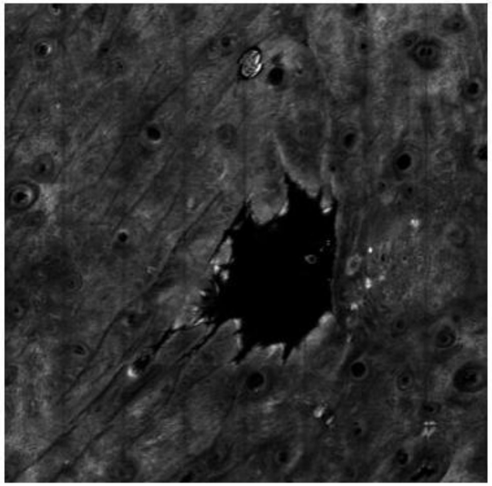

Figure 11. Confocal microscopy of acne scars before treatment.

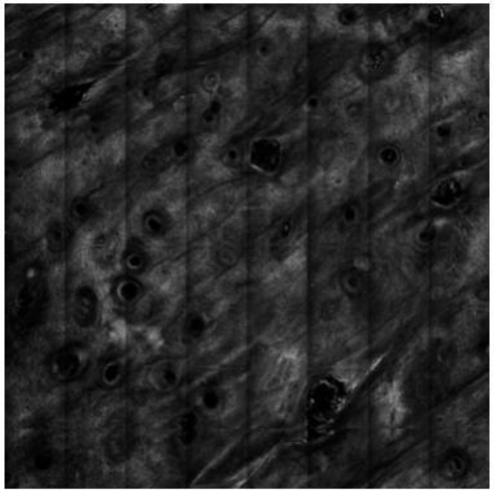

Figure 12. Confocal microscopy of acne scars after treatment with carbon dioxide laser plus radiofrequency.

Fractional CO_2 laser for the treatment of acne scars

Tokuya Omi, MD, PhD,[1,2] Seiji Kawana, MD, PhD,[2] Shigeru Sato, PhD,[3] Paolo Bonan, MD, PhD,[4] & Zenya Naito, MD, PhD[3,5]

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[3]*Central Institute for Electron Microscopic Researches, Nippon Medical School, Tokyo, Japan*
[4]*Department of Dermatology, University of Florence, Florence, Italy*
[5]*Department of Pathology, Nippon Medical School, Tokyo, Japan*

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 CO(2) 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 CO(2) 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/cm(2)). 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.

Conclusions: The fractional CO2 laser is considered to be very effective for treating atrophic acne scars.

Fractional CO_2 laser for the treatment of acne scars

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Figure 2 The morphology prior to irradiation. Moderate pitted acne scars were observed specially on the both cheek.

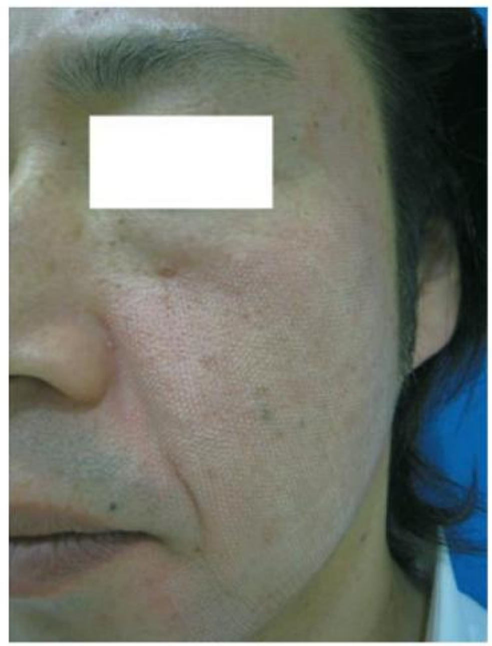

Figure 3 Grayish crust-like dots in a point grid pattern were observed immediately after the irradiation in all seven subjects. The dots were slightly erythematous from immediately after to about 1 day after the irradiation.

Figure 4 Improvement in the atrophic acne scars, compared with the condition before treatment, was observed at week 3 after the three irradiation sessions. No adverse events were noted in any of the subjects, except for the slight erythema described earlier.

Fractional CO_2 laser for the treatment of acne scars

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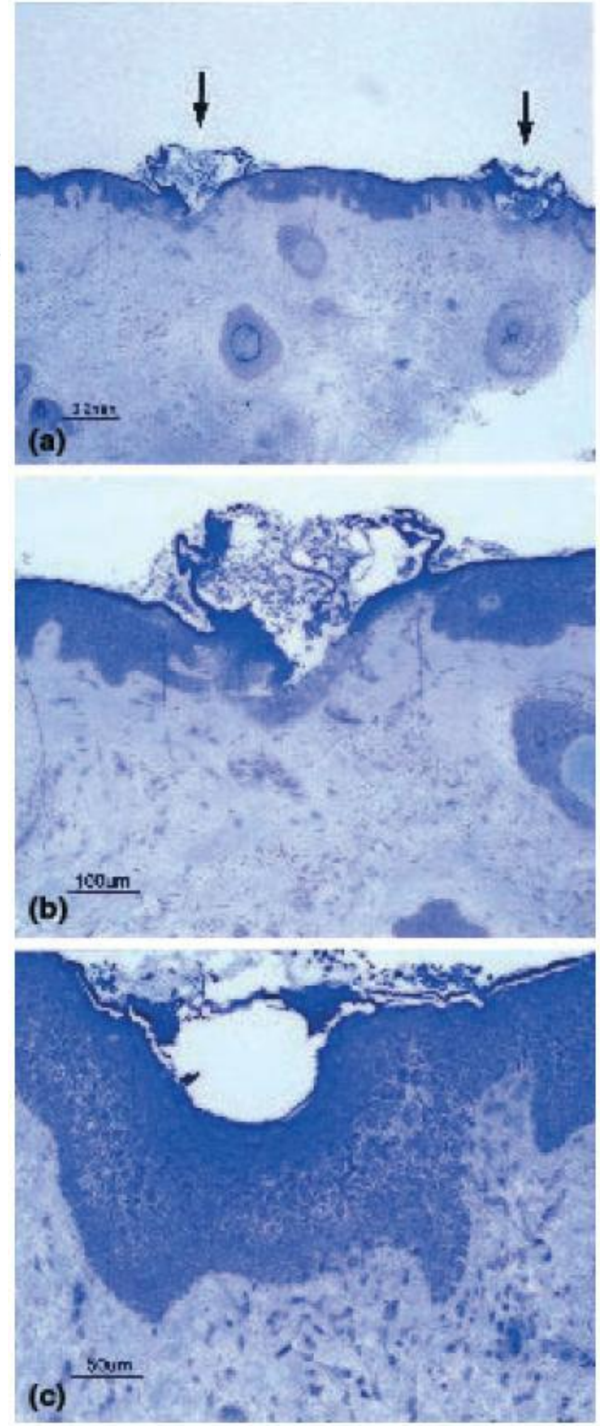

Figure: Light microscopic observations after toluidine blue staining. Immediately after each irradiation session, degeneration and desquamation of the epithelium and bleeding were observed in the irradiated area (arrow). **(a)** An en enlarged image **(b)** shows that the irradiated was desquamated, and the dermis was exposed. At week 3 after the three irradiation sessions, almost complete regeneration of the epithelium was noted **(c)**.

Fractional CO_2 laser for the treatment of acne scars

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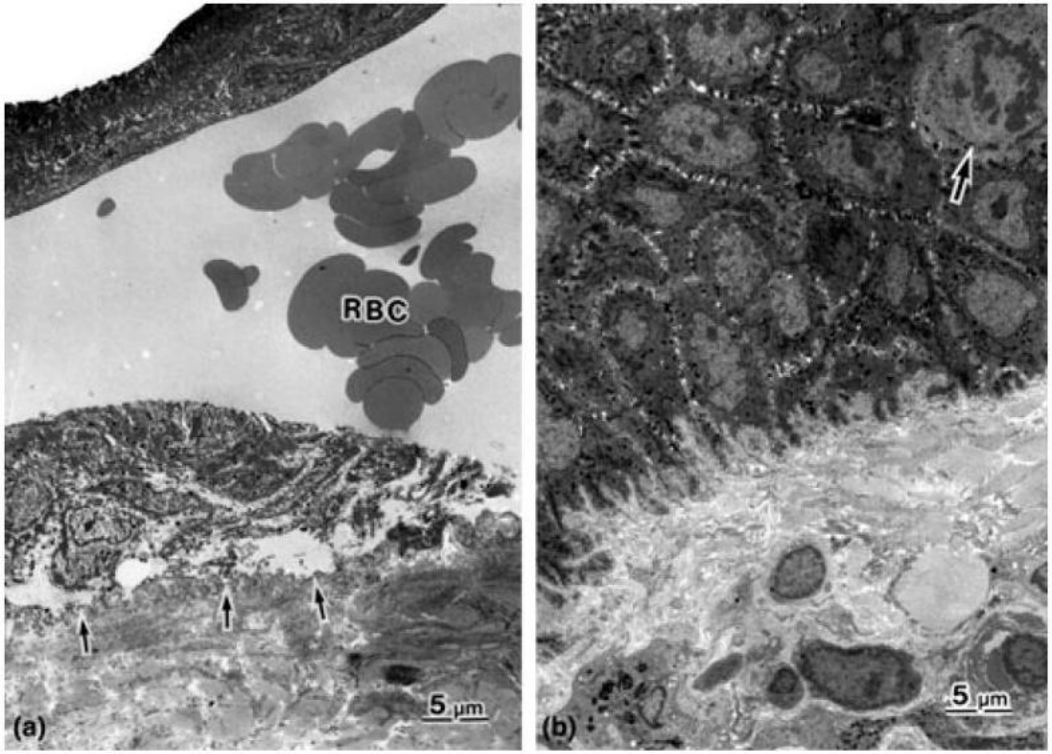

Figure 6 Ultrastructural findings in the acne scar epithelium. Prior to the treatment, no significant lesions were found in the epithelium. Immediately after each irradiation session, degeneration and desquamation of the epithelium was noted, and the basal lamina remained intact. In addition, bleeding was seen between the stratum corneum and stratum granulosum in the desquamated epithelium (a). At week 3 after the three irradiation sessions, complete regeneration of the epithelium was observed in the area of degeneration and desquamation (b). Epithelial cells undergoing mitosis (arrow) were also often observed.

Fractional CO_2 laser for the treatment of acne scars

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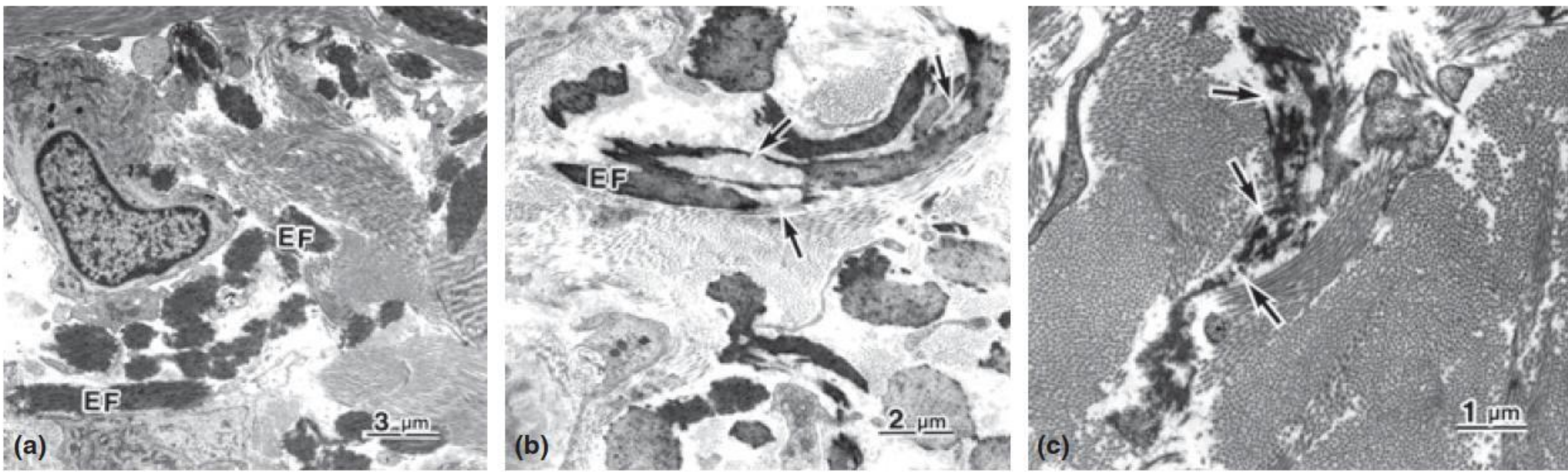

Figure 7 Ultrastructural findings in the superficial dermis in the region of the acne scars. Prior to the treatment, numerous outgrowths of elastic fibers were observed in the superficial dermis in the region of the acne scars. Examination of the specimens stained with OTE revealed the presence of elastin in the elastic fibers as electron-dense spherical or rod-shaped masses (a). Immediately after each irradiation, the localized disappearance of the elastin in the elastic fibers (arrows) was often observed (b). At week 3 after the three irradiation sessions, elastin was observed as electron-dense deposits, but the elastic fibers (arrows) as a whole were fragmented, showing a elaunin-like appearance (c).

Photomedicine and Laser Surgery
Volume 32, Number 7, 2014

Pp. 409–412
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Deep Pulse Fractional CO_2 Laser Combined with a Radiofrequency System: Results of a Case Series

Giovanni Cannarozzo, MD,[1] Mario Sannino, MD,[1] Federica Tamburi, MD,[2] Andrea Chiricozzi, MD,[1]
Rosita Saraceno, MD,[1] Cristiano Morini, MD,[1] and Steven Nisticò, MD[1,3]

Objective: The purpose of this study was evaluation of the safety and efficacy of this new combined technology that adds deep ablation to thermal stimulation.

Background data: Minimally ablative or subablative lasers, such as fractional CO2 lasers, have been developed in an attempt to achieve the same clinical results observed with traditional ablative lasers, but with fewer side effects. Despite being an ablative laser, the system used in this study is able to produce a fractional supply of the beam of light. Fractional ablation of skin is performed through the development of microscopic vertical columns surrounded by spared areas of epidermis and dermis, ensuring rapid wound healing and minimum down time. Simultaneous synchronized delivery of a radiofrequency (RF) current to the deeper layers of the skin completes the therapeutic scenario, ensuring an effective skin tightening effect over the entire treated area.

Methods: Nine adult patients were treated for wrinkles and acne scars using this new laser technology. An independent observer evaluated the improvement using a five point scale.

Results: All patients had good results in terms of improvement of skin texture, with mild and transitory side effects.

Conclusions: This novel combined system produced improvement in wrinkles and acne scars, with progressive enhancement of skin tone and elasticity

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In order to ensure better patient compliance,a topical anesthetic cream (applied about 1 h prior to treatment). Authors used a combined CO2 laser –RF device equipped with a fractional scanning system. Parameters used were: power 8-14W; spacing between dots, 500-1000 µm, number of pulses on same spot (stack) 2-4; pulse length, 600-1000 ms; scanning area (15 mm x15 mm); and RF 20-40 W, 2-3 s.

FIG. 2. **(A)** Acne scars (boxcar and icepick) before treatment in a 41-year-old patient. **(B)** Good improvement after three monthly treatments. Parameters used were: 12 W, 1000 μm spacing, 1.5 ms timing and 30 W per 3 sec radiofrequency (RF).

Journal of Cosmetic and Laser Therapy, 2012; 14: 166–171

informa healthcare

CASE REPORTS AND SHORT REPORT

Combined use of fractional CO_2 laser and radiofrequency waves to treat acne scars: A pilot study on 15 patients

STEFANIA TENNA, ANNALISA COGLIANDRO, LUCA PIOMBINO, ANGELA FILONI & PAOLO PERSICHETTI

Campus BioMedico University, Plastic Surgery Unit, Rome, Italy

Fractional laser resurfacing has become an important technique in the management of a number of skin conditions, such as photoaging and scars. A variety of laser wavelengths and delivery systems have been introduced to improve immediate and long-term therapeutic results. The simultaneous emission of CO2 laser and radiofrequency waves combines epidermal coagulation for a resurfacing effect and dermal denaturization for deeper remodelling. The authors present this new machine together with a preclinical histological study and pilot study on 15 patients suffering from acne scars.

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CASE REPORTS AND SHORT REPORT

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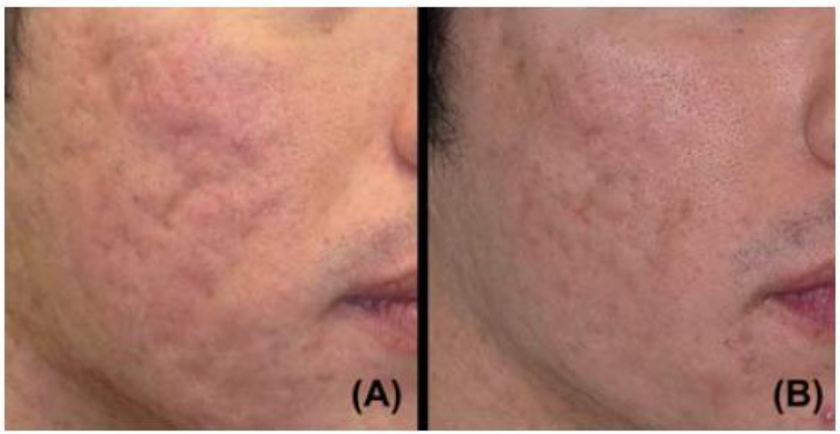

Figure 6. (A) Before and (B) after 6-month follow-up.

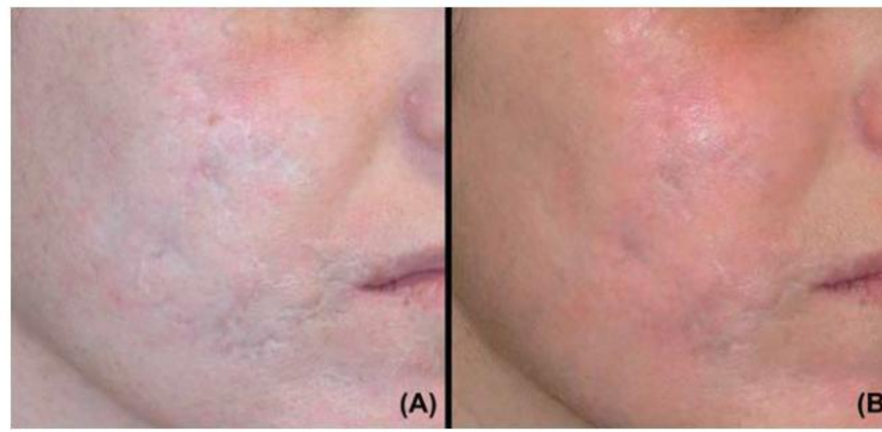

Figure 7. (A) Before and (B) after 3-month follow-up.

Figure 5. (A) Before and (B) after 12-month follow-up.

Original Contribution

Journal of Cosmetic Dermatology, **11**, 201–206

Skin tightening induced by fractional CO_2 laser treatment: Quantified assessment of variations in mechanical properties of the skin

Michael Naouri, MD,[1,2,3,4,5] Michael Atlan, MD, Msc,[1,4,6] Elodie Perrodeau, MSc,[7] Gabriela Georgesco, MD,[2,3] Randa Khallouf, MD,[3,4] Ludovic Martin, MD, PhD,[8] & Laurent Machet, MD, PhD[1,2,3]

Background: Certain authors have reported the efficacy of fractional resurfacing laser treatment in patients with photodamaged skin resulting in skin tightening of treated area.

Objective: To assess skin tightening after CO(2) fractional resurfacing laser treatment by measuring variations in mechanical properties in treated areas. Dermal elasticity was measured using suction applied with an in vivo skin elasticity meter (Cutometer(®)).

Methods: A prospective observational study was undertaken from January 2007 to August 2009. Laser treatment was performed with the SmartXide Dot(®) (Deka(®), Firenze, Italy) CO(2) fractional resurfacing device. Patients were offered quantified analysis using the Cutometer(®) before and after treatment.

Results: Seventeen patients (61 areas treated) were included in the study. Median delay between before and after cutometric evaluations was 80 days. We found **significant improvement in elastic (R2 +5.9%), viscoelastic (R8 -9.4%), fatigue (R3 and R9 -16.2% and -19.7%, respectively), and thickness (R0 -14.9%) parameters**. **These results are consistent with significant tightening and also elastic tissue improvement.**

Conclusions: It was possible to quantify skin tightening because of CO(2) fractional laser treatment using a noninvasive technique.

Original Contribution

Journal of Cosmetic Dermatology, **11**, 201–206

Skin tightening induced by fractional CO_2 laser treatment: Quantified assessment of variations in mechanical properties of the skin

Michael Naouri, MD,[1,2,3,4,5] Michael Atlan, MD, Msc,[1,4,6] Elodie Perrodeau, MSc,[7] Gabriela Georgesco, MD,[2,3] Randa Khallouf, MD,[3,4] Ludovic Martin, MD, PhD,[8] & Laurent Machet, MD, PhD[1,2,3]

Figure 3 Patient with acne scar and photoaging.

Figure 4 Same patient after laser treatment. Improvement of acne scars and skin tightening.

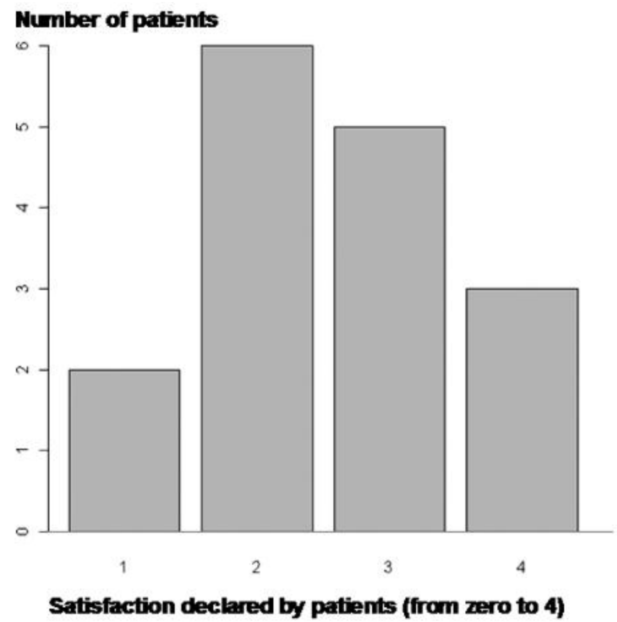

Figure 2 Patients' self-assessed satisfaction (n = 16, one data missing). Median satisfaction [Q1; Q3]: 2.5 [2; 3].

Journal of Dermatology and Plastic Surgery

Case Report
Published: 09 Nov, 2016

Hyperpigmentated Scars of the Face Following a Toxic Epidermal Necrolysis (TEN): A Case Report

Stefania Tenna, Gabriella Cassotta, Beniamino Brunetti and Paolo Persichetti*

Department of Dermatology and Plastic Surgery, "Campus Bio-Medico" University, Italy

Toxic Epidermal Necrolysis (TEN) is a rare and often fatal muco-cutaneous disease usually related to severe adverse drug reaction. The standard treatment of TEN remains controversial and to our knowledge, all reports in literature are mostly concentrated on systemic therapy. On the contrary, no report deals with deep skin scars that may occur. We therefore present an original case of a severe scarring of the face following TEN, treated by fractional CO2 laser resurfacing.

Journal of Dermatology and Plastic Surgery

Case Report
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Figure1: Preoperative view of facial hyperpigmentated scars.

Figure 2: Early postoperative result after three fractional CO_2 resurfacing.

Figure 3: Postoperative result after 18 months.

Blepharochalasis and other periocular diseases

Journal of Drugs in Dermatology

A Prospective Study of the Improvement in Periorbital Wrinkles and Eyebrow Elevation With a Novel Fractional CO_2 Laser—The Fractional Eyelift

Dvora Ancona MD[a] and Bruce E. Katz MD[b]

[a]University of Pavia; Juva Medical Center, Milan, Italy
[b]Mount Sinai School of Medicine; Cosmetic Surgery & Laser Clinic; JUVA Skin & Laser Center, New York, NY

Background and Objective: The purpose of this study was to assess the efficacy and safety of a new fractional CO2 laser 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 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, indipendent observers. Eyebrow elevation was measured by the investigators. Subject satisfaction was high and the procedure was well tolerated. Mild-to-moderate erythema and edema persisted for up to three to four days.

Results: Approximately half of subjects achieved of 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 imrpves periorbital rhytids, tightens skin and elevates the eyebrow with minimal adverse effects.

A Prospective Study of the Improvement in Periorbital Wrinkles and Eyebrow Elevation With a Novel Fractional CO_2 Laser—The Fractional Eyelift

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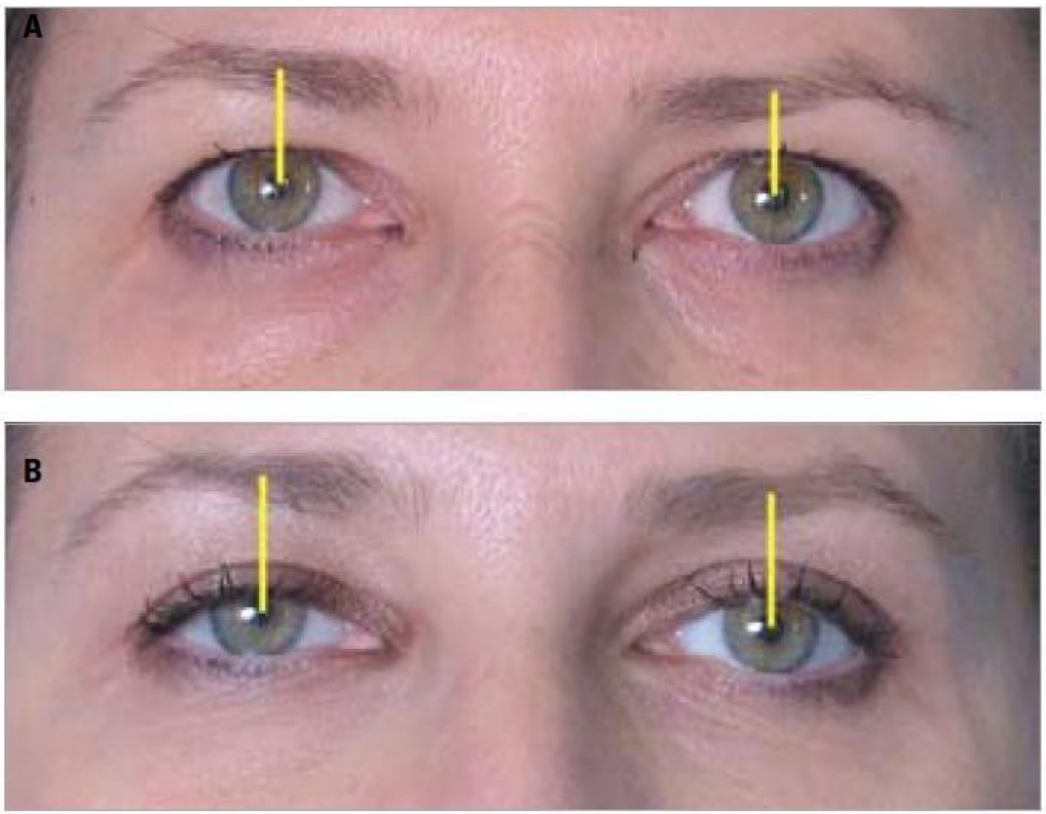

Figure: A 42-years-old woman before **a)** and 3 months after the final of two treatments **b)** with the SmartXide DOT (DEKA, Italy) fractional CO2 laser device, showing 3 to 4 mm increased eyebrow elevation and skin tightening. Settingd. 15W, 600 microseconds dwell time, 700 microns spacing.

DOI: 10.1111/j.1468-3083.2011.04034.x JEADV

ORIGINAL ARTICLE

Eyelid skin tightening: a novel 'Niche' for fractional CO_2 rejuvenation

P. Bonan, P. Campolmi, G. Cannarozzo, N. Bruscino,* A. Bassi, S. Betti, T. Lotti

Department of Dermatology II, University of Florence, Florence, Italy
*Correspondence: N. Bruscino. E-mail: bruscio@alice.it

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 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% (8 patients) showed no eyebrow elevation.

Conclusions: fractional CO2 laser treatments allow dermatologist to achieve notable improvements in eyelid skin tightening and eyebrow elevation safely and without significant side effects.

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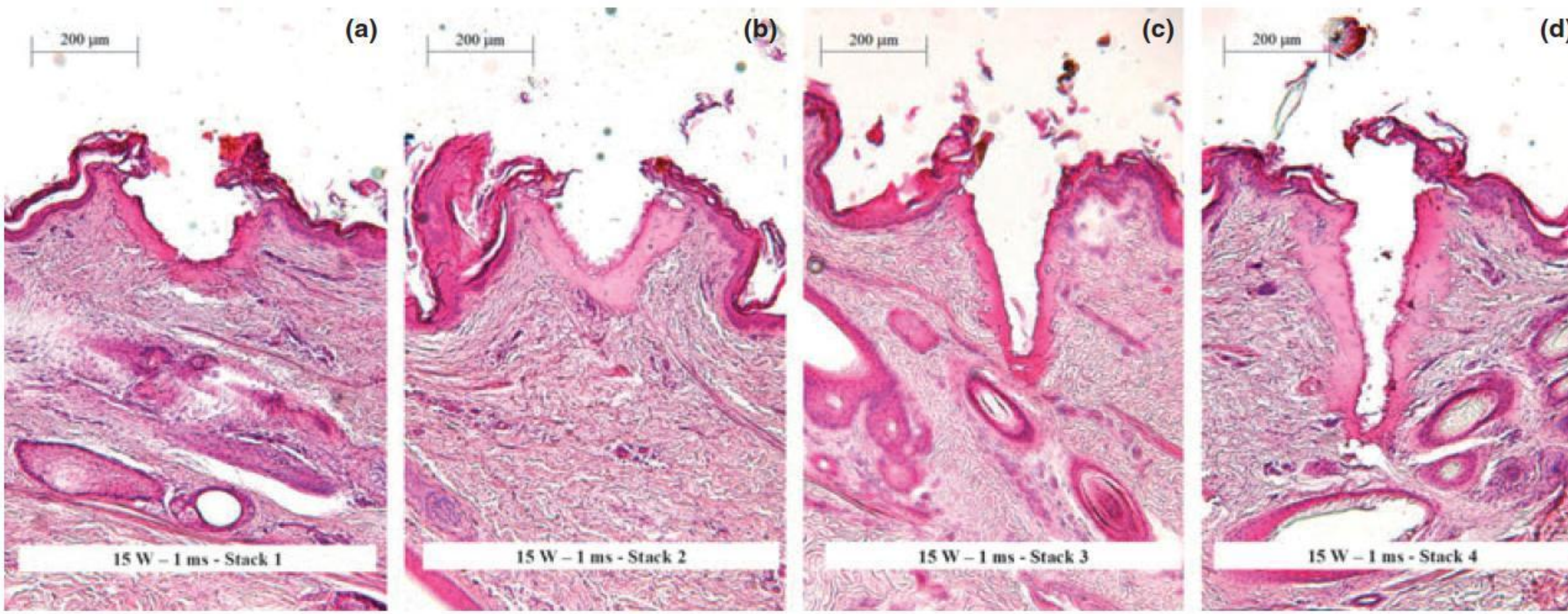

Figure 1 The Pulse Stacking mode in histological *ex vivo* specimens. (a) Stack 1 (b) Stack 2 (c) Stack 3 (d) Stack 4.

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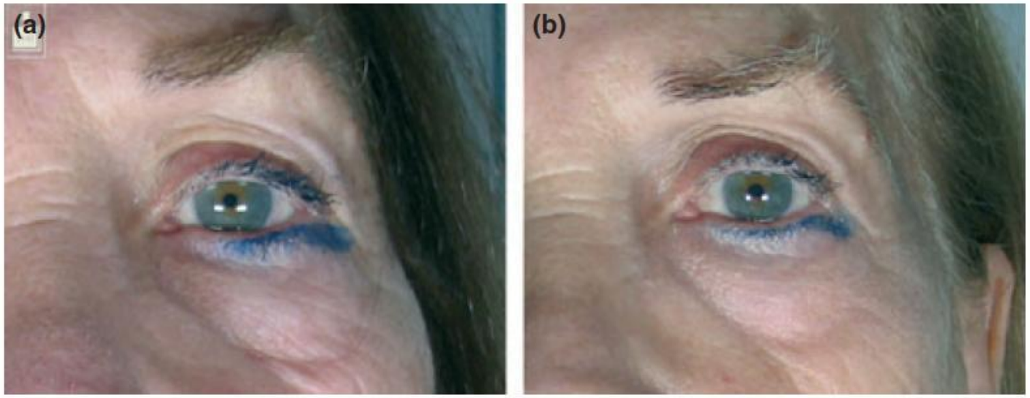

Figure 3 (a) At baseline. (b) Improvements in lower eyelid fine lines, a lift of upper eyebrow and a widened palpebral fissure after three fractional CO_2 laser treatments.

Figure 4 (a) A particular of Figure 3, at baseline. (b) It shows the improvements of the periorbital skin texture, after three treatments.

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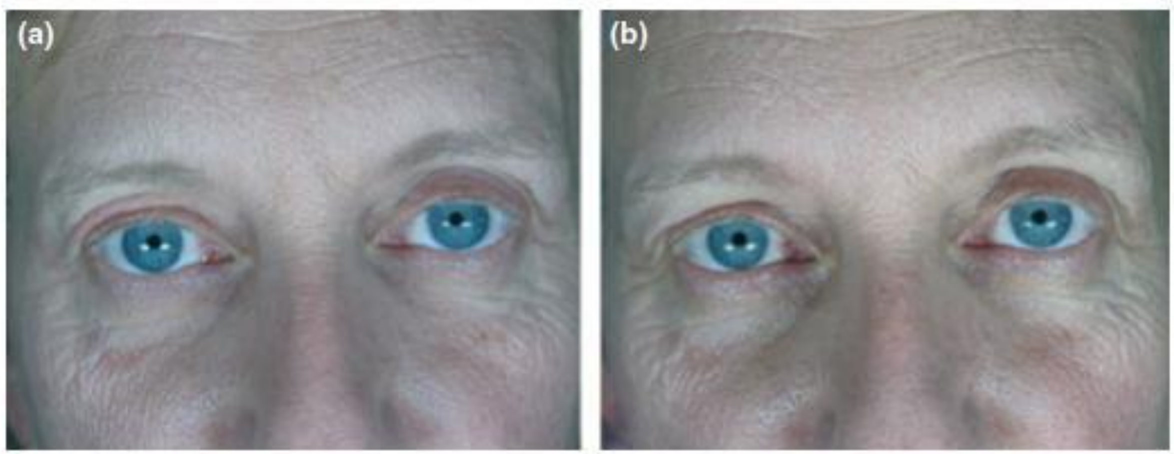

Figure 5 (a) At baseline, the patient shows a particular difference between the two palpebral fissures. (b) Improvements in upper eyelid fine lines and widened palpebral fissures after two fractional CO_2 laser treatments.

ORIGINAL ARTICLE

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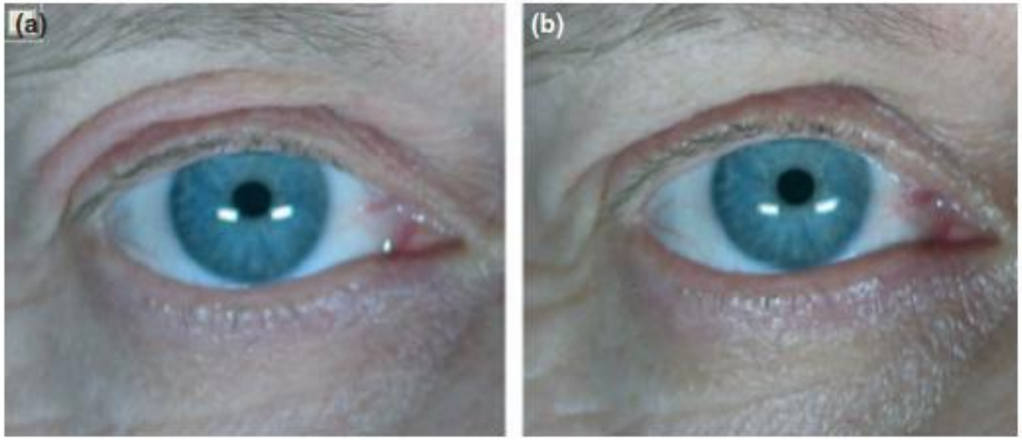

Figure 6 (a) Right eye of the patient in Figure 5, at baseline. (b) An upper eyebrow elevation and widened palpebral fissure, after two treatments.

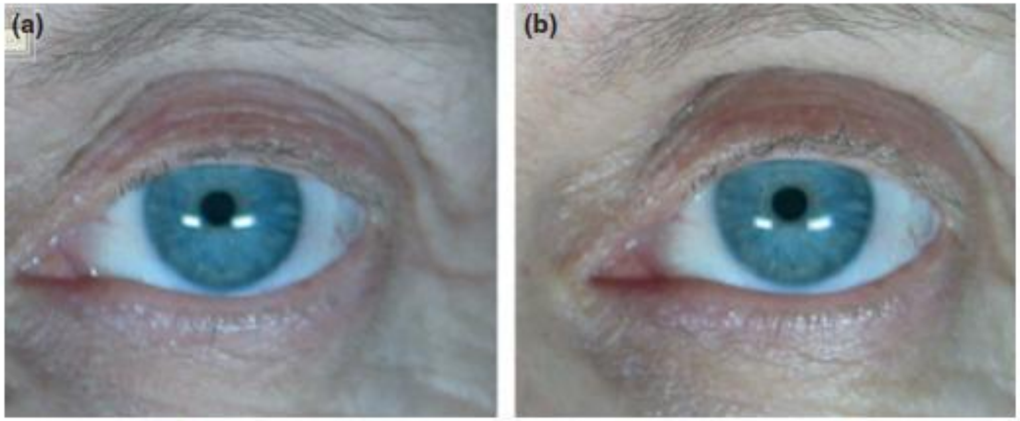

Figure 7 (a) Left eye of the patient in Figure 5, at baseline. (b) An upper eyebrow elevation and widened palpebral fissure, after two treatments.

ORIGINAL ARTICLE

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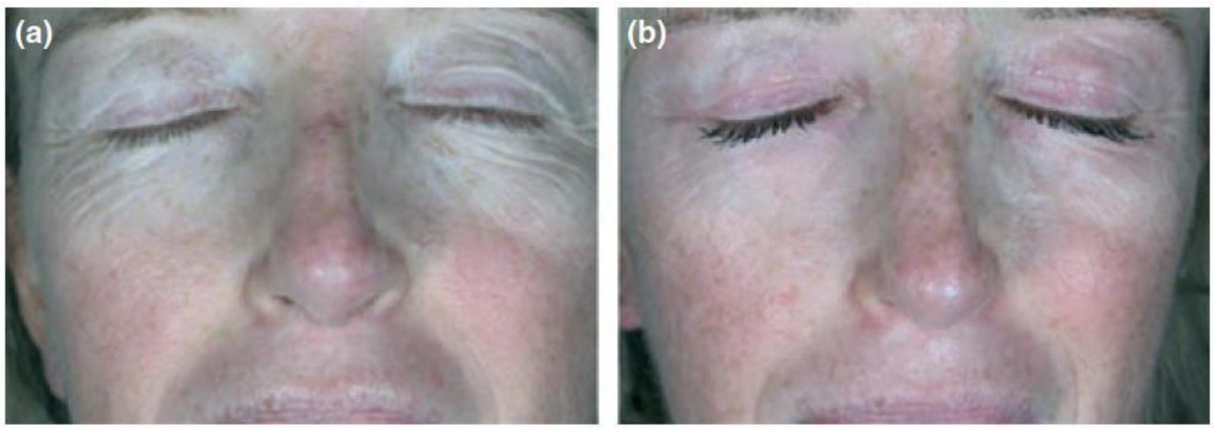

Figure 2 (a) At baseline. (b) Global improvements in eyelid skin tightening, skin texture and periorbital fine lines after fractional CO_2 laser treatments.

ORIGINAL ARTICLE

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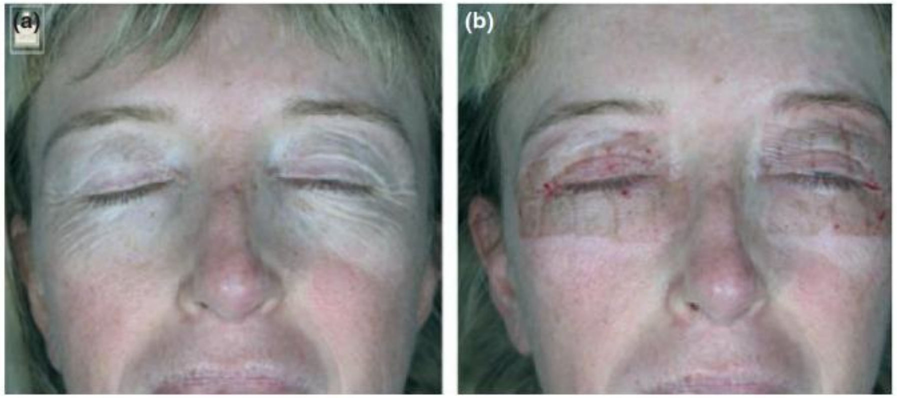

Figure 9 (a) At baseline. (b) Post-treatment fractional effect, crusting, in the treated area.

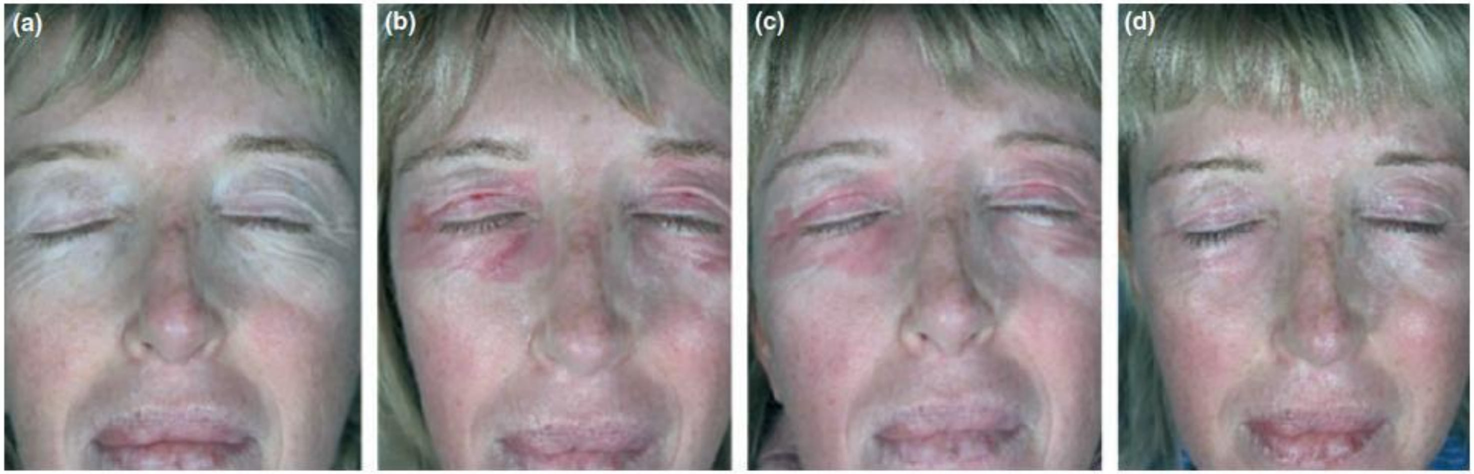

Figure 8 Long-lasting erythema during 3 months, which involved three patients of the study. (a) At baseline; (b) 2 weeks after the treatment; (c) 4 weeks after the treatment; (d) 12 weeks after the treatment.

"Split-Face" Evaluation of Collagen Changes Induced by Periorbital Fractional CO_2 Laser Resurfacing

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Juliana de Filippi Sartori, MD, PhD; Tammy Hentona Osaki, MD, PhD; Midori Hentona Osaki, MD, PhD; Rodrigo Barbosa de Souza, PhD, MSc; and Norma Allemann, MD, PhD

Background: Periorbital fractional CO2 laser resurfacing has been employed for facial rejuvenation purposes. However, to the best of our knowledge, no study has objectively assessed periorbital neoformation and remodeling of local cutaneous collagen, in a split-face model, from skin samples obtained during upper blepharoplasty.

Objectives: The authors sought to objectively evaluate neoformation and remodeling of local cutaneous collagen after periorbital skin fractional CO2 laser resurfacing.

Methods: Sixteen female patients presenting with dermatochalasis and periorbital rhytids were evaluated in a prospective and comparative study. All patients underwent unilateral periorbital fractional CO2 laser resurfacing 30 days before upper blepharoplasty. Quantification of types I and III collagen from laser-treated and untreated eyelid skin samples obtained during upper blepharoplasty was assessed with histochemical analysis (Picrosirius Red staining). Laser resurfacing treatment was applied to the untreated side immediately after the upper blepharoplasty. Two blinded, independent physicians evaluated clinical improvement in pretreatment and 1- and 6-month posttreatment digital images.

Results: Histochemical analysis showed significantly higher intensity in collagen types I (treated: 158.7 ± 5.3, untreated: 139.2 ± 5.0; $P < 0.0001$) and III (treated: 105.1 ± 7.7, untreated: 104.1 ± 7.1; $P < 0.0001$) in the fractional CO2 laser treatment samples; a greater difference was detected in collagen type I. A significant improvement in periorbital rhytidosis was observed 1 month after laser resurfacing (23%); a greater improvement in the periorbital region was observed 6 months after laser resurfacing and upper blepharoplasty (43.67%).

Conclusions: Periorbital fractional CO2 laser resurfacing was an effective method to improve palpebral skin, with histochemical evidence of increase in collagen types I and III.

"Split-Face" Evaluation of Collagen Changes Induced by Periorbital Fractional CO_2 Laser Resurfacing

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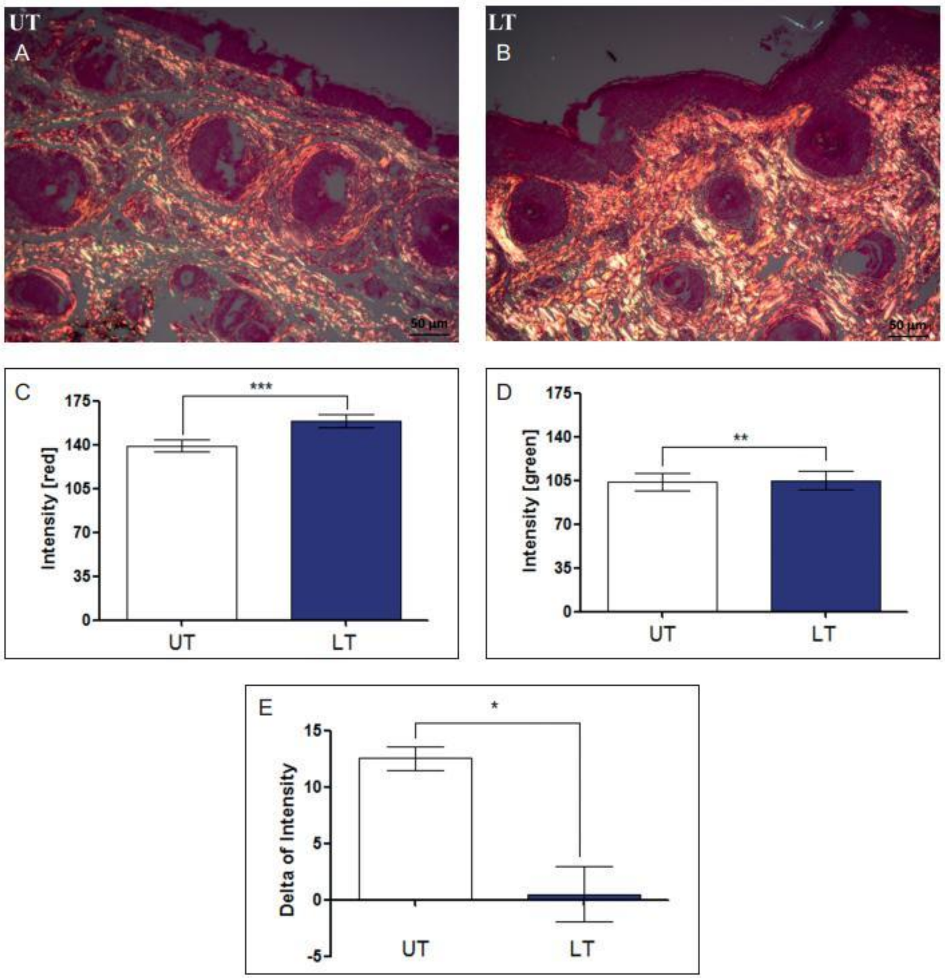

(A, B) Picrosirius red staining shows greater intensity of type I (Col I, in red) and type III collagen fibers (Col III, in green) in the laser-treated side (LT).
(C) Intensity of type I collagen (in red) and **(D)** intensity of type III collagen (in green). In both colors, the intensity in the laser-treated side (LT) was higher compared with the untreated (UT) side.
(E) Difference of the collagen between the laser-treated and untreated sides: a greater difference in type I collagen compared with type III was observed.

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Figure: Periorbital rhytidosis improvement in **(A, C, E)** this 55-year-old female patient and **(B, D, F)** this 60-year-old female patient.
(A, B) Before treatment,
(C, D) 1 month after fractional CO2 laser resurfacing treatment only, and
(E, F) 6 months after
fractional CO2 laser resurfacing treatment combined with upper blepharoplasty.

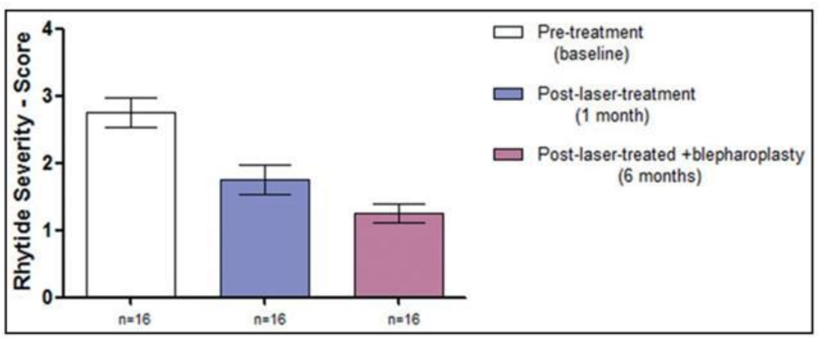

Figure 5. Rhytid severity score rated by independent observers at baseline, 1 month after laser resurfacing treatment and 6 months after laser treatment combined with upper blepharoplasty (Kruskal-Wallis Test; *P* < 0.0005).

Percutaneous Lower Blepharoplasty: A Novel Technique in Lower Eyelid Aesthetics

Huseyin Guner, MD

Background: More preservative approaches are being adopted in periorbital surgery each day. To avoid the possible complications of transcutaneous and transconjunctival blepharoplasty, the author has developed the safe and simple ‘‘Percutaneous Lower Blepharoplasty’’ technique, which he has been performing since 2008. The technique consists of the removal and transfer of lower orbital fat pads through 4-mm skin incisions with minimal dissection.

Patients and Methods: The study is designed as a retrospective analysis of the operations done by the author from 2008 to 2018. The author performed 297 percutaneous lower blepharoplasty operations alone or in combination with tear-trough deformity correction, pinch skin excision, and/or carbon dioxide laser application. The video of the technique is demonstrated in the supplemental digital content.

Results: The patients were followed for an average of 58.8 months. All the patients were satisfied with the result. There were no retractions or scleral show seen. The only complication was chemosis in 1 patient that subsided with steroid ointment.

Conclusion: Percutaneous lower blepharoplasty is a novel technique that has the following advantages: Simple and fast, low complication rates, good cosmetic outcomes, tear trough deformity correction, better estimation of fat amount to be removed, and minimal dissection and avoidance of violation of lamellar structures. It can be performed safely alone or in combination with pinch excision and/or fractional laser resurfacing.

FIGURE 2. (A) Preoperative (left) and postoperative (right) 2 years of a 45-y-old patient with percutaneous fat removal, tear-trough deformity correction, and carbon dioxide laser application. (B) Preoperative and postoperative photographs of the patient seen in (A) in the upgaze position.

Percutaneous Lower Blepharoplasty: A Novel Technique in Lower Eyelid Aesthetics

Huseyin Guner, MD

A B

FIGURE 1. (A) The orientation of orbital fat pads is illustrated. (B) The "Percutaneous Lower Blepharoplasty" technique is illustrated. Note the tactile pressure on the globe to help orbital fat bulge for easy removal.

…Postsurgery carbon dioxide fractional laser (SmartXide, DEKA, Florence, Italy) was performed immediately after surgery while the patient was on the table. A secondary session of laser treatment was added when necessary…

Percutaneous Lower Blepharoplasty: A Novel Technique in Lower Eyelid Aesthetics

Huseyin Guner, MD

FIGURE 3. (A) Preoperative (left) and postoperative 18 months of a 76-y-old patient with percutaneous fat removal and carbon dioxide laser application. (B) Preoperative and postoperative photographs of the patient seen in (A) in the upgaze position.

FIGURE 4. (A) Preoperative (left) and postoperative 4 y of a 58-y-old patient with percutaneous fat removal, tear-trough deformity correction, and carbon dioxide laser application. (Supplemental Digital Content, Video 1, http://links.lww.com/SCS/B11). (B) Preoperative and postoperative photographs of the patient seen in (A) in the upgaze position.

Percutaneous Lower Blepharoplasty: A Novel Technique in Lower Eyelid Aesthetics

Huseyin Guner, MD

FIGURE 5. (A) Preoperative (left) and postoperative 2 y of a 36-y-old patient with isolated percutaneous fat removal. (B) Preoperative and postoperative photographs of the patient seen in (A) in the upgaze position.

Photomedicine and Laser Surgery
Volume 36, Number 10, 2018
Mary Ann Liebert, Inc.
Pp. 541–547
DOI: 10.1089/pho.2018.4479

Original Research

Resurfacing with Ablation of Periorbital Skin Technique: Indications, Efficacy, Safety, and 3D Assessment from a Pilot Study

Stefania Guida, MD,[1] Steven Paul Nisticò, MD, PhD,[2] Francesca Farnetani, MD,[1]
Ester Del Duca, MD,[3] Nathalie De Carvalho, MD,[1] Flavia Persechino, MD,[1] Tommaso Verdina, MD,[4]
Luca Giannetti, MD,[5] Martina D'Alessandro,[6] Giacomo Giovanni Urtis, MD,[7]
Giovanni Pellacani, MD,[1] and Giovanni D'Alessandro, MD[8]

Objectives and background: Nowadays, several approaches for skin rejuvenation of the lower eyelid are available. We present a new technique of resurfacing with ablation of periorbital skin (RAP) performed in a single session.

Methods: This is a retrospective study involving 20 patients showing skin elastosis with or without evidence of the nasojugal fold and atrophic and dyschromic skin or needing a combined approach of transconjuntival lower blepharoplasty for fat bag removal. RAP technique is assessed in terms of efficacy, safety, and 3D evaluation of results at 6 months' follow-up.

Results: Global Assessment Improvement Scale results highlighted an improvement in all cases, for both physicians (blinded to treatment) and individual subjects. Only minor adverse events (edema, erythema, and discoloration) were reported in almost all patients, lasting 2-3 weeks after treatment, and were resolved without intervention. A 3D imaging tool revealed the reduction of medium protrusions and depressions and an improved texture at 2 months. Skin recovery was inversely correlated with hemoglobin reduction.

Conclusions: RAP seems to offer expert dermatologists a safe and clinically effective technique for skin rejuvenation of lower eyelids, without significant adverse events. Further studies will be performed to confirm our results.

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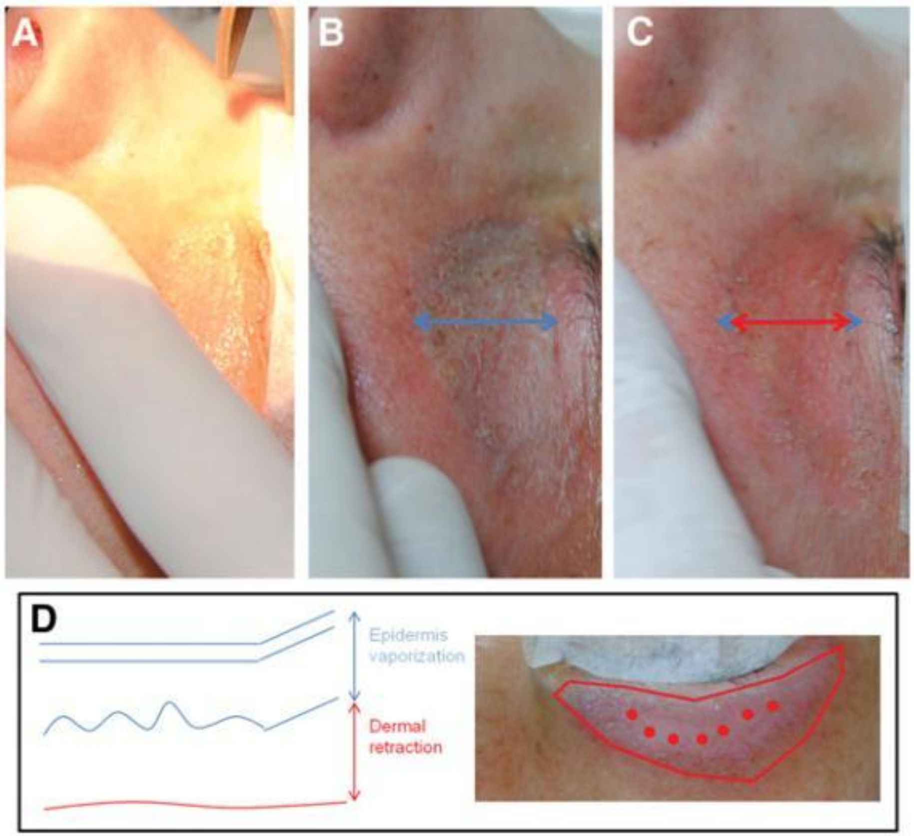

The skin was prepared with a disinfecting agent and then a topical anesthetic was applied to the treatment area.

Complete vaporization of the epidermis was performed according to the freehand motion and focused radiation, covering the entire treatment area in a homogenous manner. Settings used were power 0.5 W, energy 50 mJ, frequency 10Hz, and energy density 150-250 J/cm2 for a total of 300-500 s. Vaporized skin was not removed to avoid too superficial or too deep vaporization.

The same parameters used ofr the epidermis were employed to obtain a dermal retraction. In detail, 0.5 W power, 50 mJ energy, single u, and defocused irradiation were applied. The skin visibly retracts following a single pulse, so the distribution (linear or circular) was used depending on the area and amount of retraction observed. A single session of treatment was performed for all patients.

Fig.2. Intraoperative pictures **(A)** removal of topical anesthesia, (B) epidermis vaporization (maximum vertical diameter in blue) corresponding to opalescent skin associated with microvescicles, and c) dermal retraction (maximum vertical diameter in red) obtained after defocused irradiation of the dermis. (D) Schematic representation of how a dermal retraction can be performed. Following traction lines, a centripetal retraction is obtained with single or linearpulses. The sum of each pulse will determine the total amount of retraction.

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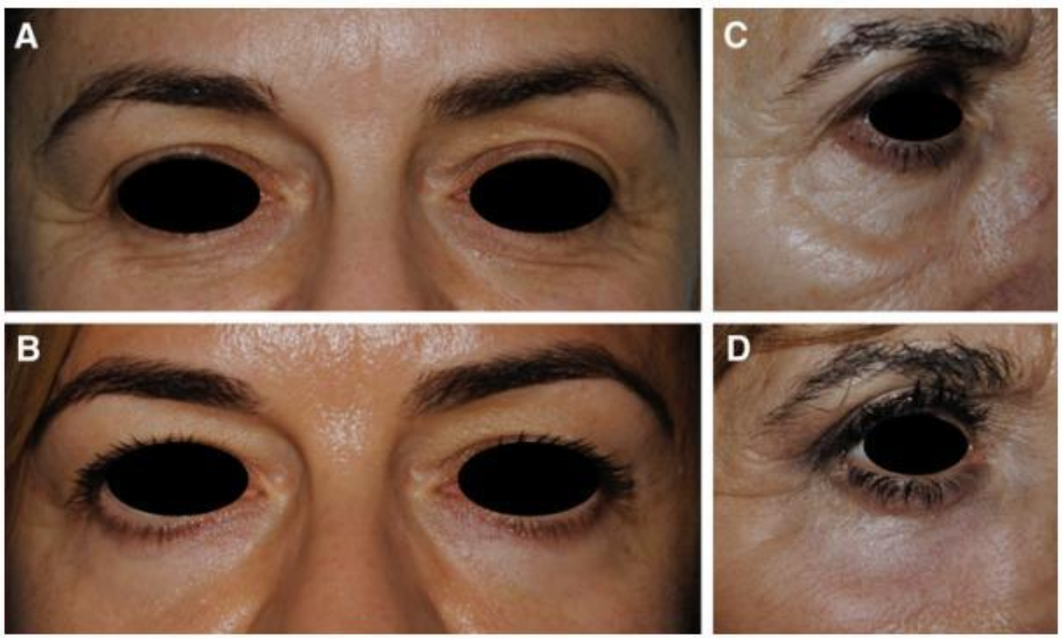

FiG.3. Clinical picture of a 45-year-old woman **(A)** pre-treatment and **(B)** 6 months post-treatmentclinical picture of a 52-year-old woman **(C)** pretreament and **(D)** 6 months post-treatment.

Table 1. Global Aesthetic Improvement Scale Scores at Month 3

PGAIS, N *(%)*	
Very much improved	13 (65)
Much improved	6 (30)
Improved	1 (5)
No change	0
Worse	0
All improved	20 (100)
SGAIS, N *(%)*	
Very much improved	15 (75)
Much improved	5 (25)
Improved	0
No change	0
Worse	0
All improved	20 (100)

PGAIS, Physician Global Assessment Improvement Scale; SGAIS, Subject Global Assessment Improvement Scale.

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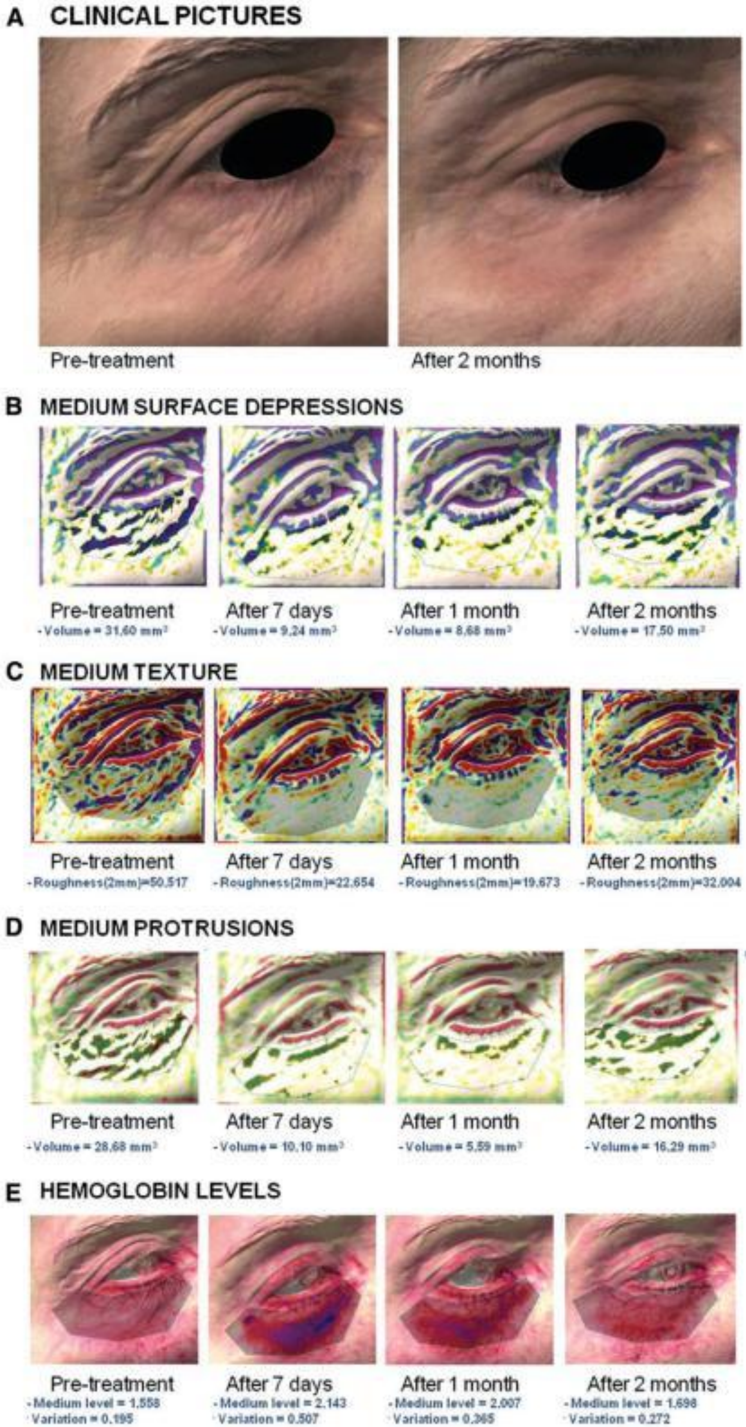
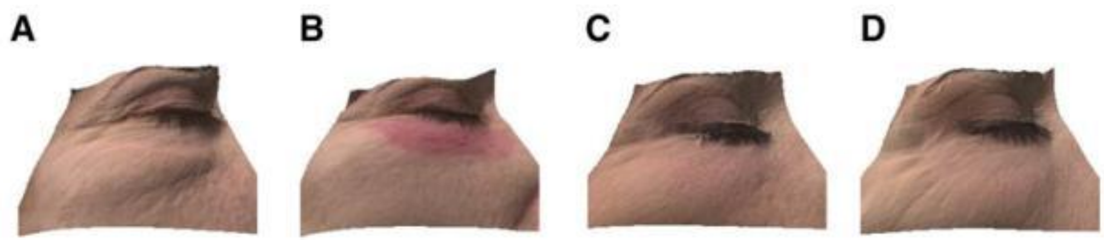


FIG. 4. Antera 3D pictures: **(A)** pretreatment and two months post-treatment of a 45-year-old woman. **(B)** Medium surface depressions at different time intervals: pretreatment, 7 days, 1 month, and 2 months post-treatment. **(C)** Medium texture at different time intervals: pretreatment, 7 days, 1 month, and 2 months post-treatment. **(D)** Medium protrusions at different time intervals: pretreatment, 7 days, 1 month, and 2 months post-treatment. **(E)** Hemoglobin at different time intervals: pretreatment, 7 days, 1 month, and 2 months post-treatment.

FIG. 6. Clinical picture of a 54-year-old patient **(A)** pretreatment and **(B)** 9 months post-treatment.

Fig.5. Antera 3D plots of a 52-year-old woman **(A)** pretreatment, **(B)** 7 days, **(C)** 1 month, and **(D)** 3 months post-treatment.



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THERAPEUTIC HOTLINE

Eyelid milia en plaque: a treatment challenge with a new CO_2 fractional laser

STEFANIA TENNA*, ANGELA FILONI*, CALOGERO PAGLIARELLO†, MAURO PARADISI†, & PAOLO PERSICHETTI*

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Milia en plaque (MEP) is an uncommon finding characterized by numerous tiny milia within an erythematous area. Despite its benign and asymptomatic nature, MEP raises cosmetic concerns; moreover, the available treatment modalities for MEP are limited. In view of the few cases described in the literature, no consensus has been reached, with respect to the optimal treatment for MEP, and the choice of therapy should be individualized. We report a case of eyelid milia en plaque successfully treated with a new CO2 fractional laser that is able to ensure superficial ablation of the epidermis remodeling tissue in-depth, with minimal thermal damage and extremely rapid recovery time. The results obtained after only two treatments were good, no scarring or dyschromic changes have been registered. At 1 year, just few recurrent milia were present.

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Eyelid milia en plaque: a treatment challenge with a new CO_2 fractional laser

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Treatments were done under topical anesthesia with 2% carbocaine and corneal shield were used to protect the eye.
Two sessions have been planned. The first treatment consisted in manual extraction of the biggest cyst, followed by fractional resurfacing with the following parameters: high peak pulse mode, 8.8 mJ energy per pulse, 4W power, 500 µm spacing. One passage only was performed.
Opthalmic antibiotic ointment was applied twice a day for 3 days. A sunscreen with SPF 50 during the first postoperative weeks was recommended.


FIG. 1. Preoperative view.


FIG. 2. Postoperative view at 1 year follow-up.

Acne

Lasers in Medical Science (2023) 38:187
https://doi.org/10.1007/s10103-023-03855-6

ORIGINAL ARTICLE

Fractional CO_2 laser versus 1064-nm long-pulsed Nd:YAG laser for inflammatory acne vulgaris treatment: a randomized clinical trial

Tasneem Muhammad Hammoda[1] · Naglaa Abdallah Ahmed[1] · Mervat Hamdino[1]

Received: 3 April 2023 / Accepted: 8 August 2023

Acne vulgaris is challenging to treat for several individuals. Laser therapy may be a desirable alternative to traditional therapies with limited success. This study aimed to assess efficacy of fractional CO2 laser versus Nd:YAG laser for acne vulgaris therapy. Thirty cases with acne vulgaris underwent both fractional CO2 laser and Nd: YAG laser treatments in a randomized split face design at a 14-day interval for four sessions. The clinical efficacy was evaluated by counting acne lesions and utilizing the Global Acne Severity Scale (GEA Scale). GEAs decreased significantly after both fractional CO2 and Nd:YAG modalities after treatment and at a 3-month follow-up; fractional CO2 demonstrated significant more decrease in GEAs with (P = 0.006, 0.00 (respectively. Moreover, fractional CO2 showed a significantly higher satisfaction level (P = 0.004) and a better clinical improvement percentage regarding inflammatory and noninflammatory acne lesions (P = 0.007 and 0.000,
respectively) after 3 months of follow-up. Apart from transient erythema, there were insignificant adverse effects concerning both treated sides. Fractional CO2 and Nd:YAG lasers are efficient physical modalities of acne treatment. However, fractional CO2 laser was more effective and more satisfying to the patients.

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Fig. 2 A 20-year-old-female patient with sever inflammatory acne (GEA scale was 4) received four treatment sessions. **A** Fractional laser side before treatment (GEAs 4, severe). **B** Fractional side at the end of treatment (1 month) (GEAs 1, almost clear). **C** Fractional side at a 3-month follow-up (GEAs 0, clear). **D** Nd-Yag laser side before treatment (GEAs 4, severe). **E** Nd-Yag side at the end of treatment (GEAs 2, mild). **F** Nd-Yag side at a 3-month follow-up (GEAs 2, mild)

On one side, a long-pulsed Nd:YAG 1064-nm laser was utilized. Lesions were treated with three consecutive overlapped passes, while the perilesional region (approximately 2 cm around the lesion) and the unaffected region (approximately 10 cm around the lesion) were treated with one pass. The fluence was 35 J/cm2 for the lesion and 30 J/cm2 for nearby and unaffected tissue; the pulse frequency was 20 ms; the spot size was 10 mm; and the cooling tip temperature was 4 °C.

On the opposite side, fractional CO2 10,600-nm laser was applied. The lesions were treated with two passes that overlapped, whereas the perilesional and uninvolved regions were medicated with a single pass. A power of 15 watts, dot mode with a spacing of 550 µm, dwell time of 400 µs, smart track, scanning mode, single stack, square form, a ratio of 10/10, and size of 100%,
were the therapy parameters with fine adjustment of these parameters according to the patient's skin type and reaction.

Ice packs were immediately applied to both sides after laser treatment. Texacort 0.1% (Hydrocortisone 17-butyrate 1 mg/gm) was advised for 3 days after the session to reduce
post laser inflammation. Patients were instructed to avoid sun exposure and using cosmetics or any topical or systemic medications during the study period and to apply sunscreen with SPF 50 on their whole face every day.

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Tasneem Muhammad Hammoda[1] · Naglaa Abdallah Ahmed[1] · Mervat Hamdino[1]

Fig. 3 A 19-year-old female patient with very severe inflammatory acne (GEA scale was 5) received four treatment sessions. **A** Fractional laser side before treatment (GEAs 5, very severe). **B** Fractional side at the end of treatment (GEAs 1, almost clear). **C** Fractional side at a 3-month follow-up (GEAs 1, almost clear). **D** Nd-Yag laser side before treatment (GEAs 5, very severe). **E**. Nd-Yag side at the end of treatment (GEAs 1, almost clear). **F** Nd-Yag side at a 3-month follow-up (GEAs 2, mild)

Table 4 Comparison between fractional side and Nd-YAG side regarding recurrence during follow-up period

Recurrence	Nd: YAG laser side	Fractional CO2 laser side	Test value	*P* value
No	23 (76.7%)	26 (86.7%)	1.002*	0.316
Yes	7 (23.3%)	4 (13.3%)		

P value > 0.05: non significant (NS); *P* value < 0.05: significant (S); *P* value < 0.01: highly significant (HS)

*: Chi-square test

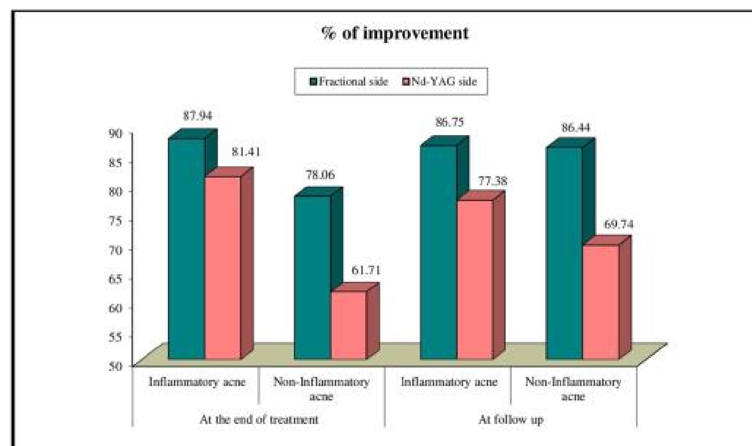

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Fig. 4 A 21-year old female patient with severe inflammatory acne (GEA scale was 4) received four treatment sessions. **A** Nd-Yag laser side before treatment (GEAs 4, severe). **B** Nd-Yag side at the end of treatment (GEAs 3, moderate). **C** Nd-Yag side at a 3-month follow-up (GEAs 3, moderate). **D** Fractional laser side before treatment (GEAs 4, severe). **E** Fractional side at the end of treatment (GEAs 3, moderate). **F** Fractional side at a 3-month follow-up (GEAs 3, moderate)

		Fractional side No. = 30	Nd-YAG side No. = 30	Test value ‡	*P* value
Satisfaction level	Median (IQR)	8 (8 – 9)	7 (6 – 9)	−2.851	0.004
	Range	7 – 10	4 – 10		
Pain level	Median (IQR)	8 (7 – 9)	5.5 (4 – 6)	−4.838	0.000
	Range	5 – 10	0 – 10		
PGIG	Median (IQR)	6 (6 – 7)	6 (5 – 6)	−3.342	0.001
	Range	6 – 7	4 – 7		

P value > 0.05: non significant (NS); *P* value < 0.05: significant (S); *P* value < 0.01: highly significant (HS)
‡: Mann Whitney test

GEA (Global Acne Severity Scale)		Fractional side No. = 30	Nd-YAG side No. = 30	Test value ‡	*P* value
Base line	Mean ± SD	3.43 ± 0.86	3.40 ± 0.89	−0.166	0.868
	Median (IQR)	3 (3 – 4)	3 (3 – 4)		
	Range	2 – 5	2 – 5		
After sessions	Mean ± SD	0.87 ± 0.73	1.47 ± 0.82	−2.733	0.006
	Median (IQR)	1 (0 – 1)	1 (1 – 2)		
	Range	0 – 2	0 – 3		
After a 3-month follow-up	Mean ± SD	0.47 ± 0.63	1.17 ± 0.91	−3.107	0.002
	Median (IQR)	0 (0 – 1)	1 (0 – 2)		
	Range	0 – 2	0 – 3		

P value > 0.05: non significant (NS); *P* value < 0.05: significant (S); *P* value < 0.01: highly significant (HS)
‡: Mann–Whitney test

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Fig. 5 A 22-year-old female patient with moderate inflammatory acne (GEA scale was 3) received four treatment sessions. **A** Fractional laser side before treatment. **B** Fractional side at the end of treatment (GEAs 0, clear). **C** Fractional side at a 3-month follow-up (GEAs 0, clear). **D** Nd-Yag laser side before treatment (GEAs 3, moderate). **E** Nd-Yag side at the end of treatment (GEAs 0, clear). **F** Nd-Yag side at a 3-month follow-up (GEAs 0, clear)

Table 5 Comparison between fractional CO2 laser side and Nd-YAG laser side regarding the Goodman and Baron qualitative and quantitative acne scarring grading system

		Fractional CO2 laser side No. = 6	Nd-YAG laser side No. = 6	Test value	*P* value
Qualitative grading					
Before	II	0 (0.0%)	1 (16.7%)	1.833	0.400
	III	5 (83.3%)	3 (50.0%)		
	IV	1 (16.7%)	2 (33.3%)		
3 months after	II	6 (100.0%)	1 (16.7%)	8.571	0.003
	III	0 (0.0%)	5 (83.3%)		
Improvement	Poor	0 (0.0%)	4 (66.7%)	6.286	0.043
	Good	5 (83.3%)	2 (33.3%)		
	Excellent	1 (16.7%)	0 (0.0%)		
Quantitative grading					
Before	Mean ± SD	15.50 ± 3.73	14.00 ± 3.85	0.686	0.508
	Range	12 – 21	10 – 19		
3 months after	Mean ± SD	4.83 ± 1.33	8.67 ± 3.27	–2.663	0.024
	Range	3 – 6	4 – 13		
P value		< 0.001 (HS)	0.002 (HS)		
% of improvement	Mean ± SD	68.67 ± 6.42	38.85 ± 14.30	4.658	0.001
	Range	57.14 – 75	18.75 – 60		
Reduction	Poor	0 (0.0%)	0 (0.0%)	6.000	0.048
	Minimal	0 (0.0%)	3 (50.0%)		
	Moderate	3 (50.0%)	3 (50.0%)		
	Good	3 (50.0%)	0 (0.0%)		

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Vitiligo

ORIGINAL CONTRIBUTION

WILEY JCD Journal of Cosmetic Dermatology

Combined treatment with fractional carbon dioxide laser, autologous platelet-rich plasma, and narrow band ultraviolet B for vitiligo in different body sites: A prospective, randomized comparative trial

Rania Abdelghani MD | Naglaa A Ahmed MD | Hanan M Darwish MD

Background: Multiple treatment options are introduced in treatment of vitiligo but the response is unsatisfactory.

Objective: In this prospective, randomized, comparative trial, we studied the effect of combined treatment with fractional carbon dioxide (CO_2) laser, platelet-rich plasma (PRP) injection, and narrowband ultraviolet B (NB-UVB) for stable nonsegmental vitiligo regarding repigmentation grade, patient's satisfaction, and side effects.

Methods: Eighty adult patients with localized nonsegmental vitiligo were enrolled in this study. The patients were randomly categorized to receive 4 lines of treatment; fractional CO_2 laser, PRP, combined fractional CO_2 laser and PRP, and combined fractional CO_2 laser and NB-UVB. The treatment period was 2 months. Patients were clinically evaluated 3 months after the last treatment. Outcome was evaluated by 5-point scale for repigmentation, 10-point visual analog scale for patient's satisfaction, and side effects.

Results: Laser and PRP group achieved the best results regarding repigmentation and patient's satisfaction. Sixty percent of the patients developed repigmentation >50% and 40% of patients developed repigmentation >75%. In laser and NB-UVB group, 5% developed repigmentation >75% and 25% developed repigmentation >50%. Only 10% of patients developed repigmentation >75% in laser group and only 20% of patients developed repigmentation >75% in PRP group.

Conclusions: Combination of fractional CO_2 laser with PRP injection is a promising treatment for vitiligo, followed by combination of fractional CO_2 laser with NB-UVB phototherapy. Both fractional CO_2 laser and PRP injection gave poor results if they received alone.

ORIGINAL CONTRIBUTION

WILEY JCD Journal of Cosmetic Dermatology

Combined treatment with fractional carbon dioxide laser, autologous platelet-rich plasma, and narrow band ultraviolet B for vitiligo in different body sites: A prospective, randomized comparative trial

Rania Abdelghani MD | Naglaa A Ahmed MD | Hanan M Darwish MD

FIGURE 1 Combined treatment with fractional CO_2 laser and PRP injection for lesions in the medial aspect of the thigh; Right: before treatment, Left: 3 months after the treatment with repigmentation >75%

- Patients received 4 sessions of fractional **CO2 laser** with 2-week interval.
- One week after each laser session, the patients received intradermal **injection of autologus PRP**. Total PRP session was 4.

FIGURE 2 Combined treatment with fractional CO_2 laser and NB-UVB for neck lesions; Right: before treatment, Left: 3 months after the treatment with repigmentation >50%

- Patients received 4 sessions of fractional **CO2 laser** with 2-week interval.
- One week after each laser session, the patients received **NB-UVB phototherapy** sessions twice per week for a maximum of 2 months. Total NB-UVB sessions was 8.

ORIGINAL CONTRIBUTION

WILEY Journal of Cosmetic Dermatology

Combined treatment with fractional carbon dioxide laser, autologous platelet-rich plasma, and narrow band ultraviolet B for vitiligo in different body sites: A prospective, randomized comparative trial

Rania Abdelghani MD | Naglaa A Ahmed MD | Hanan M Darwish MD

FIGURE 3 Treatment with fractional CO_2 laser for lesions on the back; Right: before treatment, Left: 3 months after the treatment with repigmentation >5%

FIGURE 4 Treatment with PRP injection for lesions on the neck; Right: before treatment, Left: 3 months after the treatment with repigmentation <5%

Received: 12 February 2021 | Revised: 26 April 2021 | Accepted: 5 May 2021
DOI: 10.1111/jocd.14324

JCD Journal of Cosmetic Dermatology WILEY

ORIGINAL ARTICLE

Fractional versus full ablative CO_2 laser in recipient site of non-cultured melanocytes and keratinocyte transplantation in treatment of vitiligo

Alzahraa Mohammed Jamal-edine MD | Rasha Aly El-Barbary MD |
Nayera Hassan Moftah MD

Background: Melanocyte-keratinocyte transplant procedure (MKTP) or non-cultured epidermal cell suspension transplantation is a very popular surgical modality for treating stable vitiligo. The recipient-site preparation is one potential determinant in the repigmentation outcomes.

Aim: To assess the efficacy of fractional CO2 (FCO2) laser in recipient-site preparation before MKTP and comparing it to the frequently used full surface laser ablation.

Methods: This randomized comparative trial included 19 patients with 40 stable vitiligo lesions. In each patient, the treated sites were randomly categorized into two groups according to the recipient-site ablation (either fractional or full ablative CO2 laser). Assessment of repigmentation was performed six months after the procedure.

Results: Both modalities achieved successful repigmentation of a median of 80% and 77.5% for fractional and full ablation groups, respectively, with a non-statistically significant difference between them. The median of VASI change percent was −73% and −71% with fractional and full surface ablation, respectively.

Conclusions: FCO2 laser ablation is effective for recipient-site preparation before cell suspension transplantation as well as the full ablative CO2 laser.

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DOI: 10.1111/jocd.14324

JCD Journal of Cosmetic Dermatology WILEY

ORIGINAL ARTICLE

Fractional versus full ablative CO_2 laser in recipient site of non-cultured melanocytes and keratinocyte transplantation in treatment of vitiligo

Alzahraa Mohammed Jamal-edine MD | Rasha Aly El-Barbary MD | Nayera Hassan Moftah MD

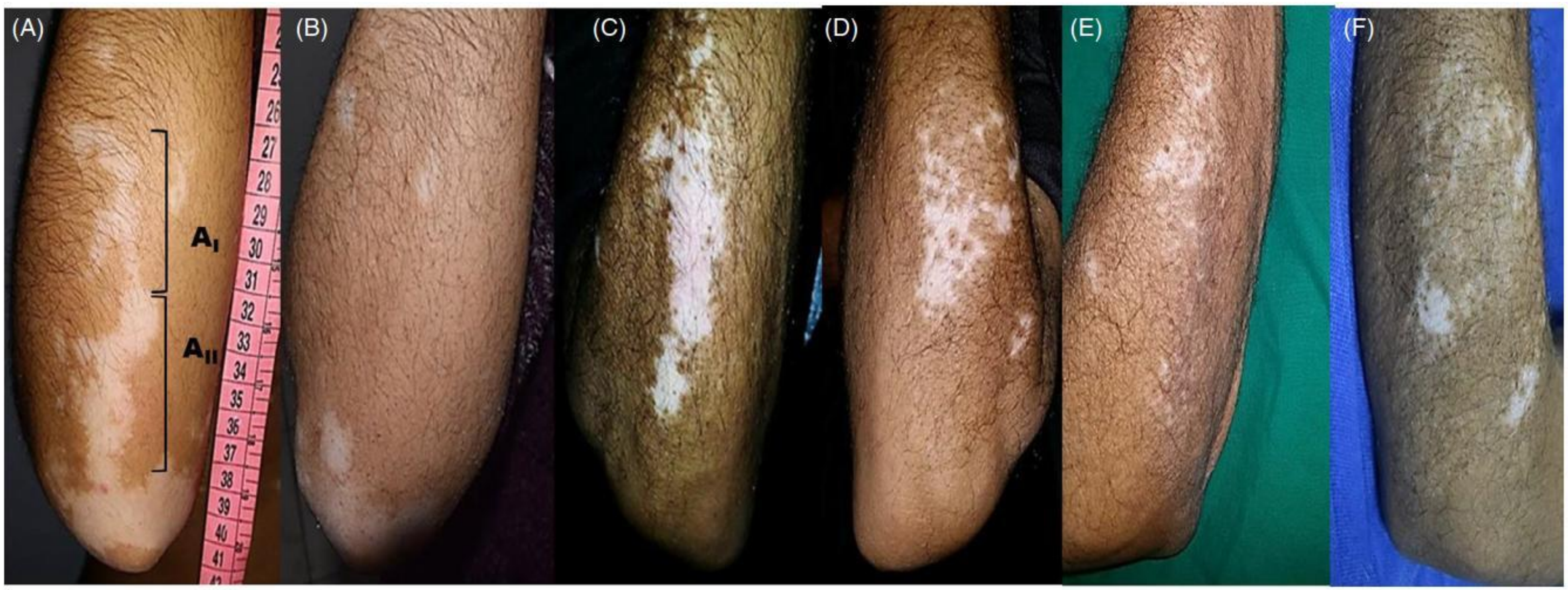

FIGURE 1 (A): Stable nonsegmental vitiligo (NSV) of the right forearm of a patient before treatment using fractional CO_2 laser (A_I) and full ablative CO_2 laser (A_{II}). (B): Six months later, the response was excellent (100%) repigmentation at both sites. (C and D): Stable NSV of both forearm of a patient before treatment. Six months later, the response was good (80%) after using both fractional CO_2 laser (E) and full ablative CO2 laser (F)

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ORIGINAL ARTICLE

JCD Journal of Cosmetic Dermatology WILEY

Fractional versus full ablative CO_2 laser in recipient site of non-cultured melanocytes and keratinocyte transplantation in treatment of vitiligo

Alzahraa Mohammed Jamal-edine MD | Rasha Aly El-Barbary MD | Nayera Hassan Moftah MD

FIGURE 2 (A): Stable nonsegmental vitiligo (NSV) of the right leg of a patient before treatment using fractional CO_2 laser (A_I) and full ablative CO_2 laser (A_{II}). Six months later, the response was excellent (90%) repigmentation at both sites (B_I and B_{II}). (C): Stable NSV of the right leg of a patient before treatment using fractional CO_2 laser (C_I) and full ablative CO_2 laser (C_{II}). (D): Six months later, the response was good (75%) repigmentation at fractional ablation site (D_I) and excellent (90%) repigmentation at full ablation site (D_{II})

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ORIGINAL ARTICLE

JCD Journal of Cosmetic Dermatology WILEY

Fractional versus full ablative CO_2 laser in recipient site of non-cultured melanocytes and keratinocyte transplantation in treatment of vitiligo

Alzahraa Mohammed Jamal-edine MD | Rasha Aly El-Barbary MD | Nayera Hassan Moftah MD

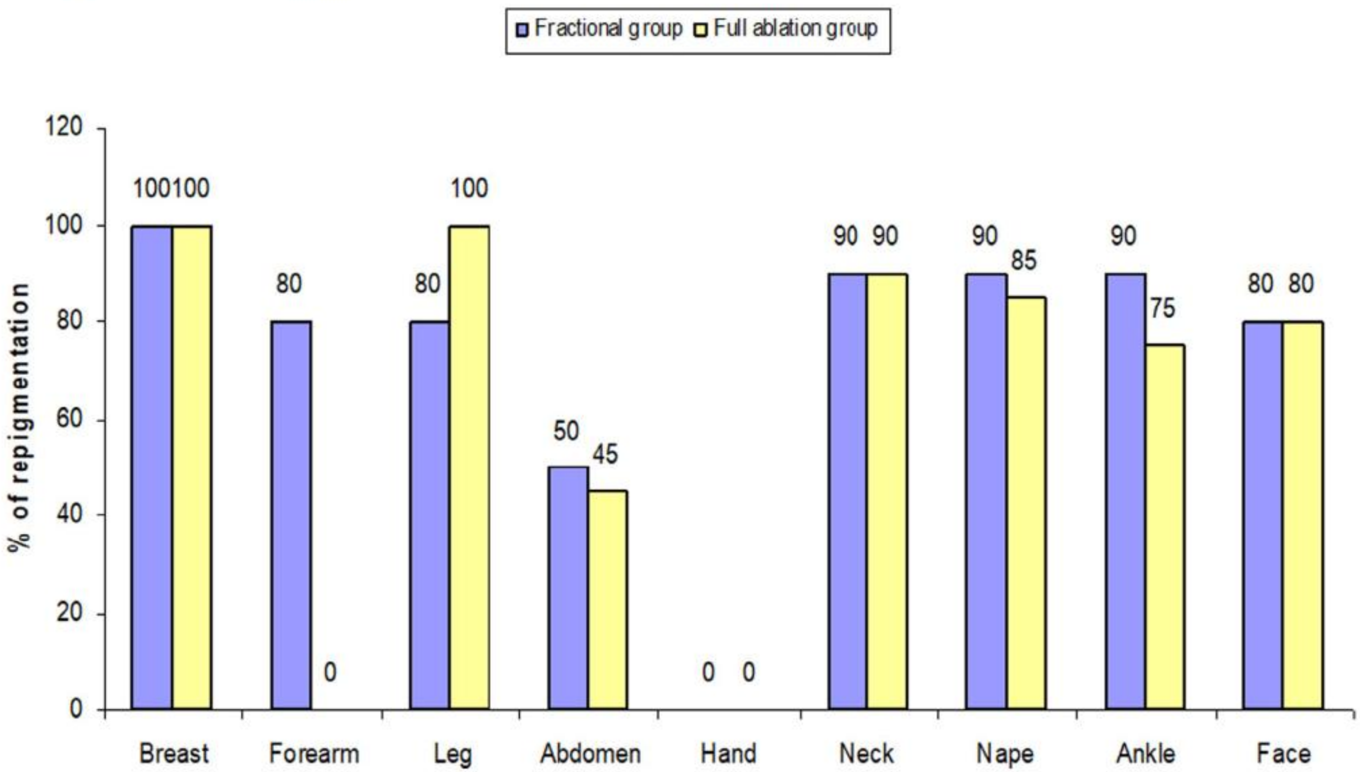

FIGURE 3 Relation between site and mean percent of repigmentation

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Pigmented Disorders

Acanthosis Nigrican

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ORIGINAL CONTRIBUTION

JCD Journal of Cosmetic Dermatology WILEY

Fractional carbon dioxide laser versus trichloroacetic acid peel in the treatment of pseudo-acanthosis nigricans

Fatma Eldeeb MD[1,2] | Reham M. Wahid MD[3] | Rania Alakad MD[1,2]

Background: Treatment of acanthosis nigricans (AN) is challenging, and new modalities are being explored continuously to increase the therapeutic efficacy.

Aim: To evaluate the efficacy and safety of fractional CO2 laser compared to trichloroacetic acid (TCA) peel in the treatment of pseudo-acanthosis nigricans (pseudo-AN).

Methods: The study included 40 patients with pseudo-AN on the neck and axilla allocated into two groups each containing 20 patients. Group (A) was treated with TCA 20% peel applied on the pigmented area while group (B) received fractional CO2 laser. Both treatments were performed till complete clearance or for a maximum of four treatment sessions. Patients with excellent response were further followed up for 6 months after the end of treatment.

Results: Both modalities were effective in the treatment of pseudo-AN; however, the therapeutic response was significantly higher in the fractional CO2 laser group compared to the TCA peel group ($p < 0.01$). Marked to excellent response (51%–100% clearance of AN lesions) was achieved in 85% of the patients in the fractional laser group versus 10% of the patients in the TCA group. Adverse effects, for example, persistent erythema, post-inflammatory hyperpigmentation, and burning sensation, were also statistically higher in the TCA group compared to the laser group ($p = 0.04$).

Conclusion: Fractional CO2 laser is a promising effective and well-tolerated treatment modality for pseudo-acanthosis nigricans.

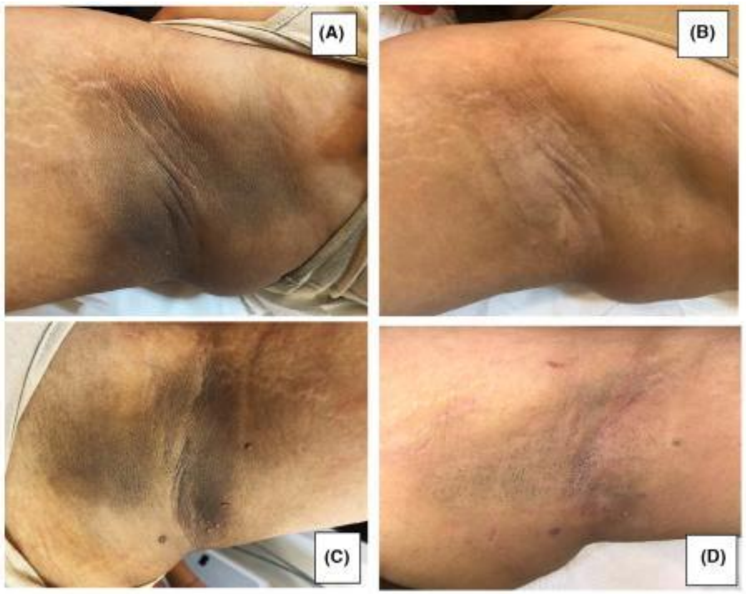


FIGURE 2 Pseudo-acanthosis nigricans in the axilla. (A) Pseudo-acanthosis nigricans in the right axilla before treatment. (B) Excellent response (76%–100% improvement of AN lesions) after two sessions of fractional CO2 laser. (C) Pseudo-acanthosis nigricans in the left axilla before treatment. (D) Excellent response (76%–100% improvement of AN lesions) after two sessions of fractional CO2 laser

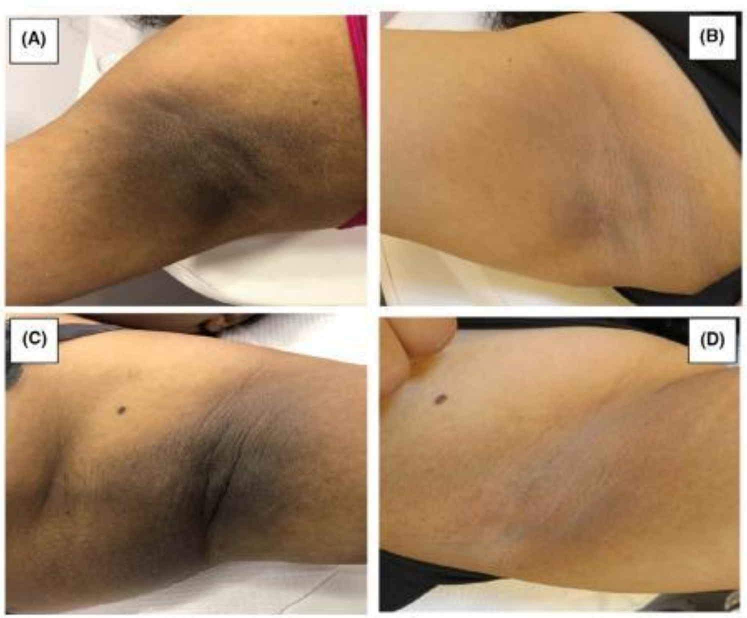


FIGURE 3 Pseudo-acanthosis nigricans in the axilla. (A) Pseudo-acanthosis nigricans in the right axilla before treatment. (B) Complete clearance of pseudo-AN lesions after three sessions of fractional CO2 laser. (C) Pseudo-acanthosis nigricans in the left axilla before treatment. (D) Complete clearance of pseudo-AN lesions after three sessions of fractional CO2 laser

Preoperative topical anesthetic cream (pridocaine 5%) was applied for 60 min under occlusion on the treated site.
Fractional CO2 laser (DEKA Smartxide DOT C60) was used.
Each patient received a treatment session every 4–6 weeks until complete clearance or for a maximum of four sessions.
The used laser parameters included power (10 w), density (31.8%), dwell time (200 µs), and spacing (200 µm) with a single pass on the affected areas without overlapping.

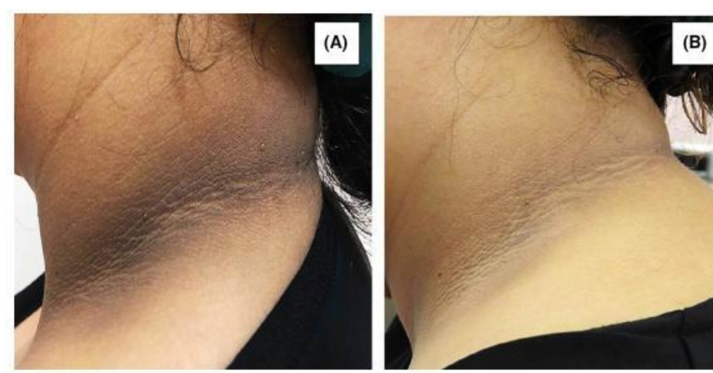


FIGURE 1 Pseudo-acanthosis nigricans on the neck. (A) Before treatment with TCA 20% peel. (B) Marked response (51%–75% improvement of AN lesions) after four sessions of TCA 20% peel

› J Cosmet Dermatol. 2022 Mar;21(3):1023-1030. doi: 10.1111/jocd.14224. Epub 2021 May 31.

Comparative study between fractional carbon dioxide laser versus retinoic acid chemical peel in the treatment of acanthosis nigricans

Ayat A Abu Oun [1], Naglaa A Ahmed [1], Hala S A Hafiz [1]

Background: Acanthosis nigricans (AN) is a common dermatological issue with several therapeutic modalities to treat. Despite retinoid is the first drug of choice in the treatment, the fractional-ablative carbon dioxide (CO_2) laser has revealed as a promising procedure for the management of neck-AN, outstanding to its ability for superficial ablation of the skin surface, with trans-epidermal melanin elimination.

Objectives: To decide whether fractional-ablative CO2 laser or retinoic acid (5%) peel is the more effective and safe choice for AN treatment.

Methods: In this study, twenty Egyptian cases with neck-AN were enrolled, where each case was exposed to four sessions with 2 weeks apart of both fractional CO2 laser on the right half of the neck and retinoic acid peel on the left half of the neck. Cases were assessed by a scoring system: Acanthosis Nigricans Area and Severity Index (ANASI) score, two blinded dermatologists, and dermoscopically before and one month after treatment.

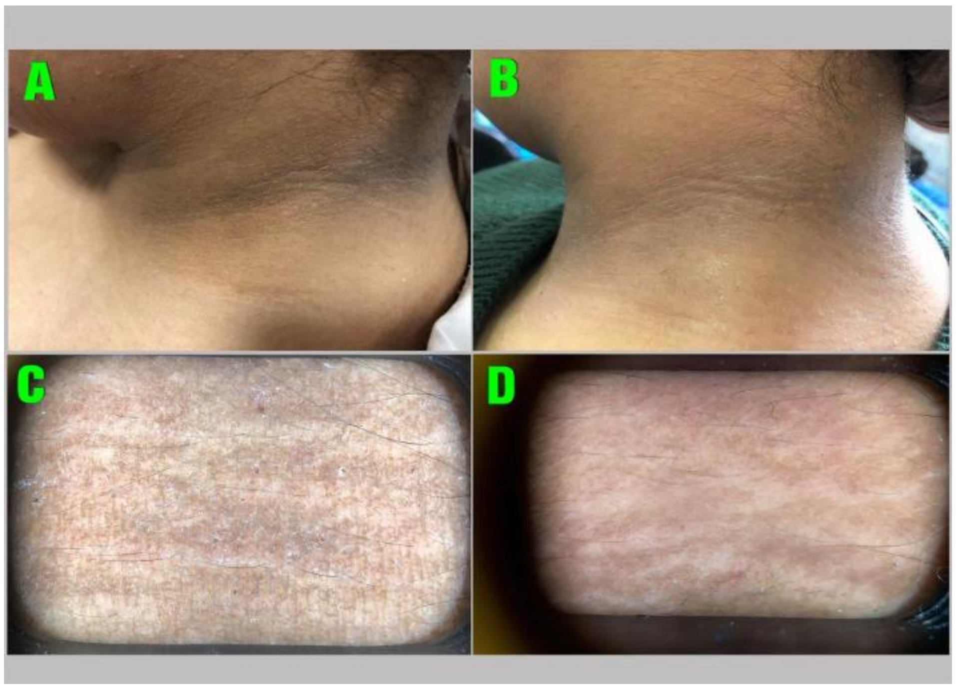
Results: We found a highly statistically significant improvement among both treated groups regarding (ANASI) score and dermatologist's assessments. Bedside, the degree of sulci cutis, cristae cutis, brown-to-dark brown dots, and milia-like cysts, dermoscopic sign improvement was evident in both treated groups. However, fractional CO2 laser shows the superior result to retinoic acid peel in the treatment.

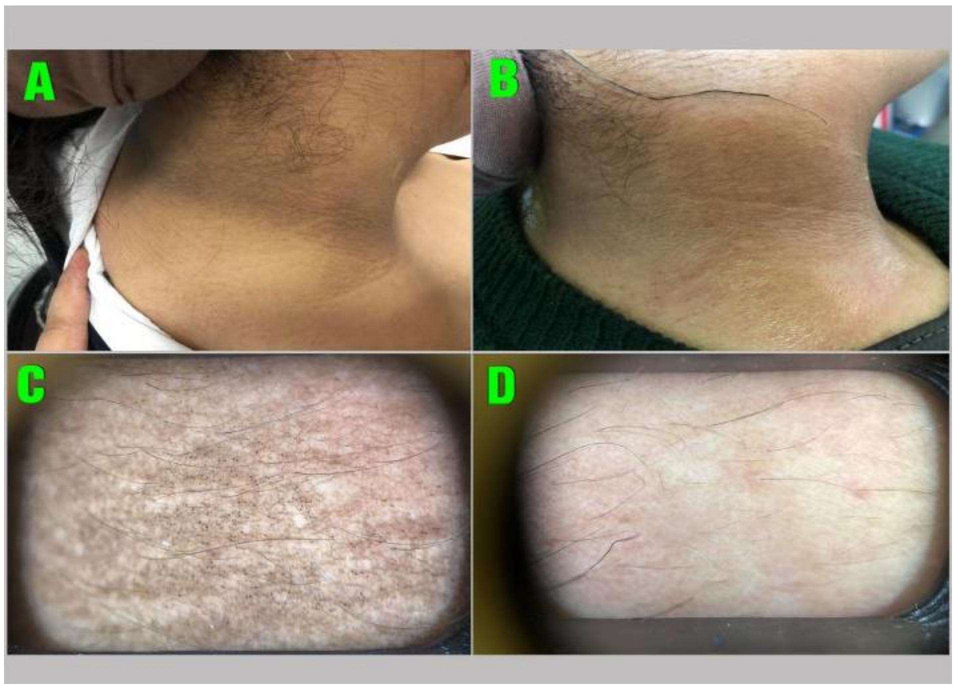
Conclusion: Fractional CO2 laser and retinoic acid peel are considered effective modalities for neck-AN treatment. However, fractional CO2 laser was more effective.

J Cosmet Dermatol. 2022 Mar;21(3):1023-1030. doi: 10.1111/jocd.14224. Epub 2021 May 31.

Comparative study between fractional carbon dioxide laser versus retinoic acid chemical peel in the treatment of acanthosis nigricans

Ayat A Abu Oun [1], Naglaa A Ahmed [1], Hala S A Hafiz [1]





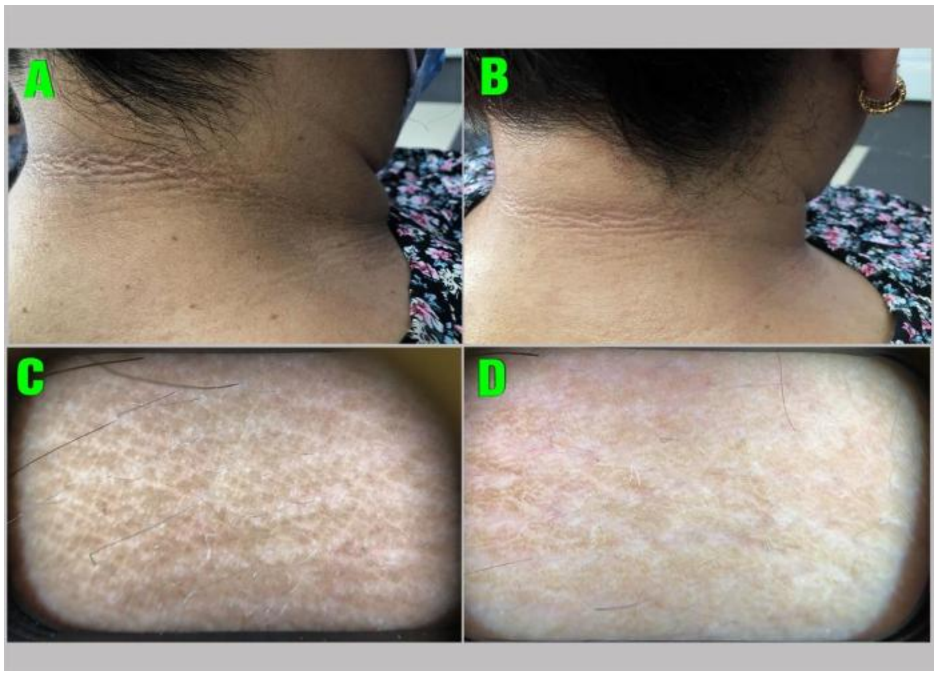
Regards the dermoscopic assessment, the number of improved dermoscopic signs was higher in the laser-treated half [19 (95%), 19 (95%), 15 (75%), and 8 (40%)] than on the peeling-treated half [17 (85%), 17 (85%), 6 (30%), and 4 (20%)] regarding sulci cutis, cristae cutis, brown-to-dark brown dots, and milia-like cysts respectively.

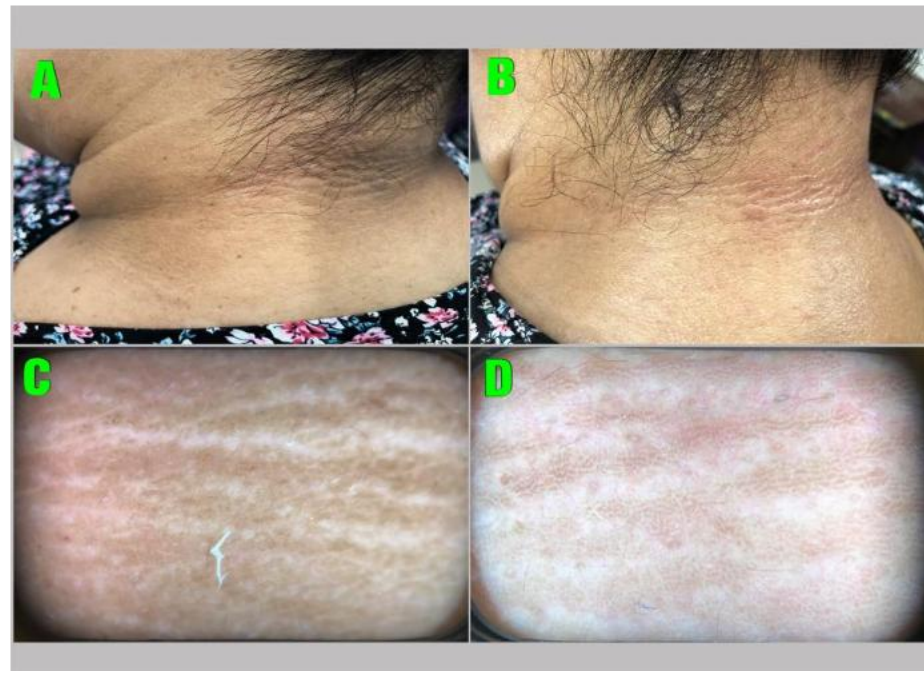
While there was no significant difference between laser and peeling halves regards the improvement of; sulci cutis, cristae cutis, and milia like cysts, a highly significant difference were found regards the improvement of brown-to-dark brown dots between both halves for the laser-treated half over the pealing-treated half

› J Cosmet Dermatol. 2022 Mar;21(3):1023-1030. doi: 10.1111/jocd.14224. Epub 2021 May 31.

Comparative study between fractional carbon dioxide laser versus retinoic acid chemical peel in the treatment of acanthosis nigricans

Ayat A Abu Oun [1], Naglaa A Ahmed [1], Hala S A Hafiz [1]





Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Pigmented Disorders

Laser Induced Hyperpigmentation

November 2010 1420 Volume 9 • Issue 11

CASE REPORTS
SPECIAL TOPIC
Journal of Drugs in Dermatology

Treatment of CO_2 Laser Induced Hypopigmentation With Ablative Fractionated Laser Resurfacing: Case Report and Review of the Literature

Emily P. Tierney MD[a,b,c] and C. William Hanke MD MPH[b]

[a]Tufts University School of Medicine
[b]Laser and Skin Surgery Center of Indiana, Carmel, IN
[c]South Shore Skin Center, Plymouth MA

Background: The carbon dioxide laser (CO2) has been proven 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 onset 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 pigmentary 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.

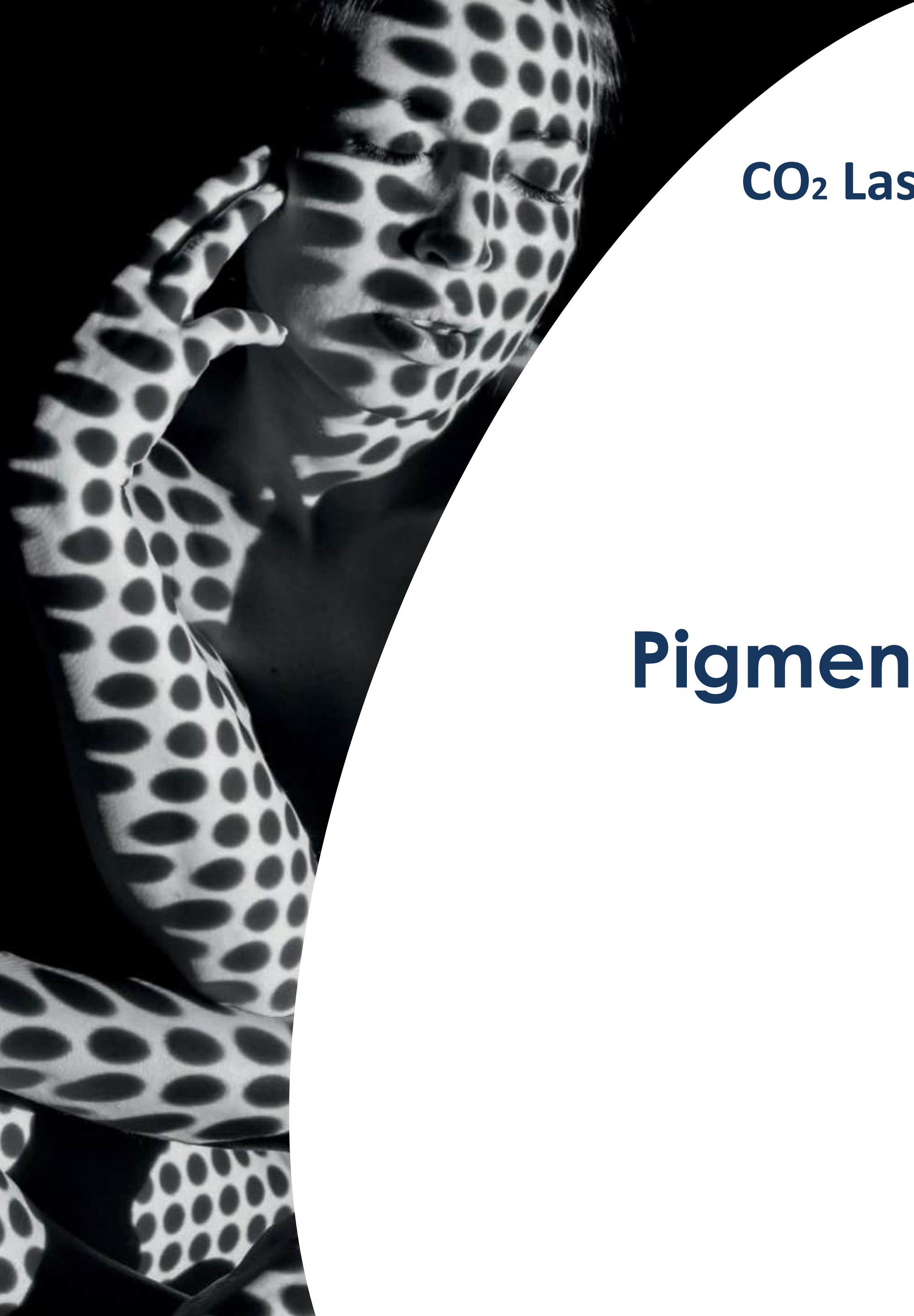
Treatment of CO_2 Laser Induced Hypopigmentation With Ablative Fractionated Laser Resurfacing: Case Report and Review of the Literature

Emily P. Tierney MD[a,b,c] and C. William Hanke MD MPH[b]
[a]Tufts University School of Medicine
[b]Laser and Skin Surgery Center of Indiana, Carmel, IN
[c]South Shore Skin Center, Plymouth MA

FIGURE 1. Frontal facial view. Pre- and post-treatment of CO_2 laser induced hypopigmentation with ablative fractional CO_2 laser (DOT Laser, DEKA, Calenzano Italy). Photos used with permission from C. William Hanke MD MPH.

FIGURE 2. Left lateral facial view. Pre- and post-treatment of CO_2 laser induced hypopigmentation with ablative fractional CO_2 laser (DOT Laser, DEKA, Calenzano Italy). Photos used with permission from C. William Hanke MD MPH.

FIGURE 3. Right lateral facial view. Pre- and post-treatment of CO_2 laser induced hypopigmentation with ablative fractional CO_2 laser (DOT Laser, DEKA, Calenzano Italy). Photos used with permission from C. William Hanke MD MPH.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Pigmented Disorders

Skin Rash

European Journal of Plastic Surgery
https://doi.org/10.1007/s00238-018-1443-y

CASE REPORT

Adverse drug reaction with silodosin: a case report of an unusual skin rash

Stefania Tenna[1,2] · Marco Morelli Coppola[1] · Beniamino Brunetti[1] · Paolo Persichetti[1]

Received: 23 May 2018 / Accepted: 25 July 2018

Silodosin is a selective alpha-1 adrenergic receptor antagonist approved for the treatment of lower urinary tract symptoms associated with benign prostatic hypertrophy. Adverse events include retrograde ejaculation, dizziness, diarrhea, vasodilator symptoms, and postural hypotension. Skin adverse reactions to silodosin such as eruption, purpura, and jaundice are uncommon.
This article reports a case of unusual silodosin-related skin rash, Naranjo score 5, which regressed after applying combined intense pulsed light (IPL)/fractional CO2 laser/chemical treatments and drug interruption.

European Journal of Plastic Surgery
https://doi.org/10.1007/s00238-018-1443-y

CASE REPORT

Adverse drug reaction with silodosin: a case report of an unusual skin rash

Stefania Tenna [1,2] · Marco Morelli Coppola [1] · Beniamino Brunetti [1] · Paolo Persichetti [1]

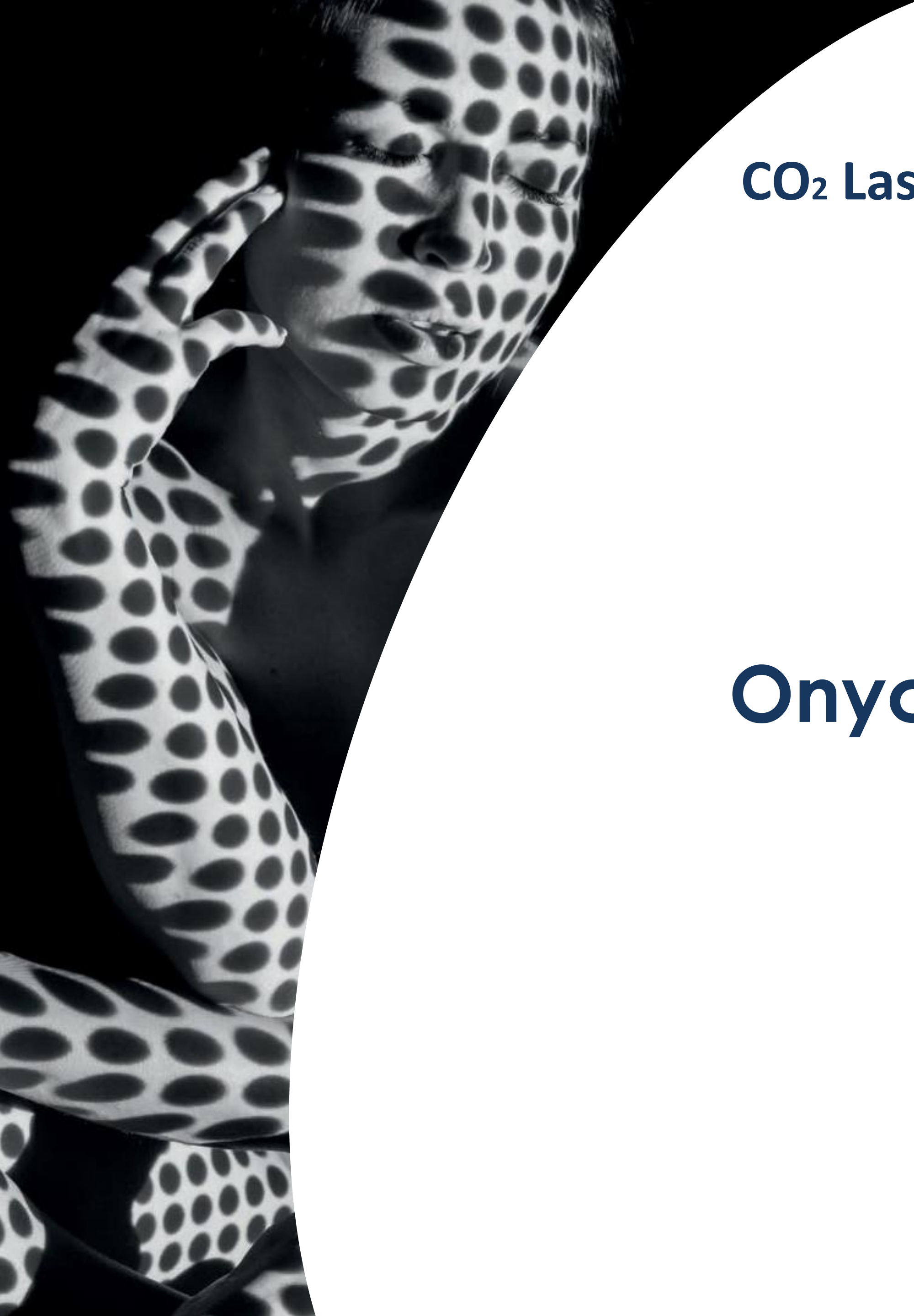
Received: 23 May 2018 / Accepted: 25 July 2018

Fig. 1 Pretreatment view of bilateral mandibular skin rash. Skin lesions are purple/bluish and do not blanch with pressure

Fig. 2 Post-treatment view with a complete resolution of the eruption

Authors performed two treatment sessions, 2 months apart, with intense pulsed light (IPL), (Synchro HP, DEKA M.E.L.A., Calenzano, Italy), at 500 nm wavelength, single pulse, at 8 J/cm2. Topical application of gentamicin sulfate cream 0.1% twice a day and zinc oxide cream was recommended on the first few days after treatments and patient was advised to avoid direct sun exposure for 3 weeks after treatment.

Then the patient underwent three fractional CO2 (SmartXide Punto, DEKA M.E.L.A.,
Calenzano, Italy) laser treatments, 3 months interval, with these parameters: H-pulse, a DOT spacing of 500 µm at 9 W. Following each fractional CO2 laser session the patient
applied for 4 weeks a cream containing kojic acid in 4% concentration, formulated with glycolic acid (10%) and hydroquinone (1%), to increase efficacy



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Onychomycosis

Received: 30 August 2019 | Revised: 28 October 2019 | Accepted: 1 November 2019
DOI: 10.1111/dth.13155

ORIGINAL PAPER

DERMATOLOGIC THERAPY WILEY

Fractional CO_2 laser plus topical antifungal versus fractional CO_2 laser versus topical antifungal in the treatment of onychomycosis

Amr Mohamed Zaki | Hamed Mohamed Abdo | Mohamed Anwer Ebadah |

Onychomycosis is an important medical disorder affecting both health and quality of life of patients. This study was done to compare the efficacy of CO2 laser in combination with topical tioconazole versus CO2 laser only versus topical tioconazole alone in onychomycosis. A total of 120 patients with onychomycosis were randomly assigned to three groups.
Group A patients were treated with fractional CO2 laser followed by topical tioconazole 28% for five sessions with 3 weeks interval.
Group B patients were treated with only fractional CO2 laser for five sessions with 3 weeks interval.
Group C patients were treated with only topical tioconazole 28% for 16 weeks.
The clinical effect, KOH examination, and culture for the affected nails in the three groups were analyzed. One month after the last session, regarding clinical response, 55% showed complete clinical improvement in Group A versus 30% in Group B versus 25% in Group C with a significant difference in between. There was a significant difference between the three studied groups as regard KOH test and culture after treatment. Fractional CO2 laser combined with topical antifungal is a safe and effective treatment for onychomycosis.

Received: 30 August 2019 | Revised: 28 October 2019 | Accepted: 1 November 2019
DOI: 10.1111/dth.13155

ORIGINAL PAPER

DERMATOLOGIC THERAPY WILEY

Fractional CO_2 laser plus topical antifungal versus fractional CO_2 laser versus topical antifungal in the treatment of onychomycosis

Amr Mohamed Zaki | Hamed Mohamed Abdo | Mohamed Anwer Ebadah |

FIGURE 1 "A case of DLSO" (a) Photographs of left-hand index and middle fingernails with moderate DLSO at baseline. (b) 3 months after treatment with CO_2 laser plus topical tioconazole showed a significant clinical response (patient from Group A)

FIGURE 2 "A case of DLSO" (a) Photographs of right big toe with moderate DLSO at baseline. (b) 3 months after treatment with CO_2 laser only, showed a complete clinical response (patient from Group B)

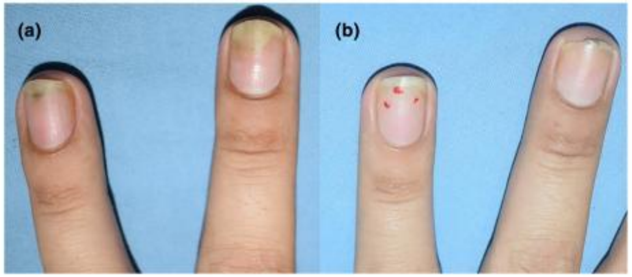


FIGURE 3 "A case of DLSO" (a) Photographs of left middle and ring fingernails with mild DLSO. (b) 3 months after treatment with topical tioconazole alone, showed a significant clinical response (patient from Group C)

In **Group A**, the affected nails were treated with a fractional CO2 laser 10,600 nm (SmartXide Square, DEKA, Florence, Italy) was used with parameters: Power of 10–15 W (according to nail thickness), H-Pulse shape, pulse duration of 500 µs, spacing of 700–800 µm and Stack 3 for five sessions at 3-weeks interval plus topical tioconazole 28% solution applied twice per day to the affected nail plates and nail folds for 16 weeks (endpoint).

In **Group B**, fractional CO2 laser 10,600 nm was used as a treatment for our patients with the same parameters in Group A for five sessions at 3-weeks interval alone for 16 weeks (endpoint).

In **Group C**, the affected nails were treated with daily topical tioconazole 28% solution only twice per day for 16 weeks (endpoint).

Drug Delivery

Transcutaneous Drug Delivery by Liposomes Using Fractional Laser Technology

Takahiro Fujimoto, MD, PhD,[1,2*] **Jian Wang,** BSc,[2] **Kazuki Baba,** BSc,[2] **Yuka Oki,** BSc,[2] **Yuki Hiruta,** PhD,[2] **Masayuki Ito,** MSc,[3] **Shinobu Ito,** PhD,[4] **and Hideko Kanazawa,** PhD[2]
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Objective: Transdermal delivery of hydrophilic peptides remains a challenge due to their poor cellular uptake and trnsdermal penetration. We hypothesize that combination of a CO2 fractional laser to enhance percutaneous absorption and liposomes as transdermal carriers would improve skin penetration of hydrophilic drugs.

Methods: Liposomes were prepared using membrane fusion lipid dioleoylphosphatidylethanolamine, and used to deliver 5-carboxyfluorescin (CF) and fluorescein isothiocyanate-conjugated ovalbumin (OVA-FITC) as model hydrophilic peptide drugs. Liposome size was estimated by dynamic light scattering. Liposome uptake into murine macrophage cells and penetration or permeation into Yucatan micropig skin after irradiation by CO2 fractional laser at varying energy levels (laser power and exposure duration) were investigated using Franz cell and fluorescence microscopy. Oxidative damage to the irradiated mouse skin was assessed by electron spin resonance.

Results: Size of CF and OVA-FITC encapsulated liposomes was 324 ± 75 nm. Cellular uptake of OVA-FITC delivered by liposomes was 10-fold higher (1,370 relative fluorescence units, RFU) than delivered in solution form (130 RFU). **Fractional laser irradiation increased skin permeation rate of CF liposomes (0–10%) and OVA-FITC liposomes (4–40%) in a dose-dependent manner.** Although peeling off the stratum corneum facilitated CF liposome penetration at low energy levels (2.69–3.29 J/cm2; 10–20 W for 500 ms), drug permeation was similar (7–8%) in peeled or untreated skin at higher laser energy levels (6.06 J/cm2; 20 W for 1,500 ms). **FITC penetrated deeper in the skin after laser irradiation.** However, OH, O2-, and VC reactive oxygen species were generated upon irradiation of the skin with a fractional CO2 laser.

Conclusions: **Increasing laser power and irradiation, time increased liposome uptake by cells and penetration of peptide drugs across the skin in a dose-dependent manner. High-energy CO2 fractional laser overcomes the rate-limiting barrier function of the stratum corneum.** Further investigations are required to establish the safety and efficacy of fractional laser-irradiation assisted delivery of liposome-encapsulated drugs as a transcutaneous drug delivery system.

Pediatric Dermatology WILEY

Fractional CO_2 laser-assisted topical rifamycin drug delivery in the treatment of pediatric cutaneous leishmaniasis

Giuseppe Lodi MD[1] | Mario Sannino MD[1] | Paolo Caterino MD[1] | Giovanni Cannarozzo MD[1] | Luigi Bennardo MD[2] | Steven Paul Nisticò PhD, MD[2]

FIGURE 2 Immediately after the first laser session, frontal view

Cutaneous leishmaniasis is challenging to treat. Various drugs have been proposed to manage this condition, with variable results. In this case report, we describe laser-assisted delivery of rifamycin to treat this infection. Two sessions of fractional CO2 laser were performed one month apart. Each was followed by a topical application of rifamycin for three days. Resolution with minimal scarring was obtained, suggesting this technique might be safe and effective in treating cutaneous leishmaniasis.

- Topical anesthetic cream (Pliaglis® Difa Cooper S.p.A. Caronno Pertusella, Italy) was applied one hour before each treatment.

- Ablative fractional CO2 laser (Deka Laser SmartXide2 DOT/RF® Deka Mela, Calenzano, Italy) treatment (power 5 W, spacing 500 µm, dwell time 1500 µs, fluence 2.46 J/cm2, pulse energy 17.8 mJ) was performed on the lesion.

- Topical 0.5% rifamycin solution (Rifocin® solution 90 mg/18 mL, Sanofi-Aventis S.p.A.) was applied on the treated area every 4 hours after treatment for the first 16 hours and then twice a day for the following two days . No other topical ointments were used after the procedure.

- After one month, we performed another laser session with subsequent application of topical rifamycin, using the same protocol.

CASE REPORT

Pediatric Dermatology WILEY

Fractional CO_2 laser-assisted topical rifamycin drug delivery in the treatment of pediatric cutaneous leishmaniasis

Giuseppe Lodi MD[1] | Mario Sannino MD[1] | Paolo Caterino MD[1] | Giovanni Cannarozzo MD[1] | Luigi Bennardo MD[2] | Steven Paul Nisticò PhD, MD[2]

FIGURE 1 A, Baseline, frontal view. B, Baseline, lateral view

FIGURE 3 A, Eight months after the first session, frontal view. B, Eight months after the second session, lateral view

Wound Healing

CLINICAL REPORT

Efficacy and safety of CO_2 laser in the treatment of chronic wounds: A Retrospective Matched Cohort Trial

Haonan Guan MD[1,2] | Di Zhang MD[1,2] | Xian Ma MD[1,2] | Yechen Lu MD[1,2] | Jiaoyun Dong MA[1,2] | Yiwen Niu MD[1,2] | Yingkai Liu MD[1,2] | Shuliang Lu MD, PhD[1,2] | Jiping Xu MD, PhD[3] | Jiajun Tang MD, PhD[1,2]

FIGURE 7 Case. A 67-year-old male, with a body mass index (BMI) of 29, had a 20-year history of type 2 diabetes, with lower limbs arteriosclerotic obliteration, had a wound with exposed bone in his left foot for >6 months. The wound healed 56 days after CO_2 laser treatment. (A) Before CO_2 laser treatment. (B) Immediately after CO_2 laser treatment, laser drilling can be seen on the exposed bone. (C) 3 weeks after CO_2 laser treatment. (D) 6 weeks after CO_2 laser treatment

Efficacy and safety of CO_2 laser in the treatment of chronic wounds: A Retrospective Matched Cohort Trial

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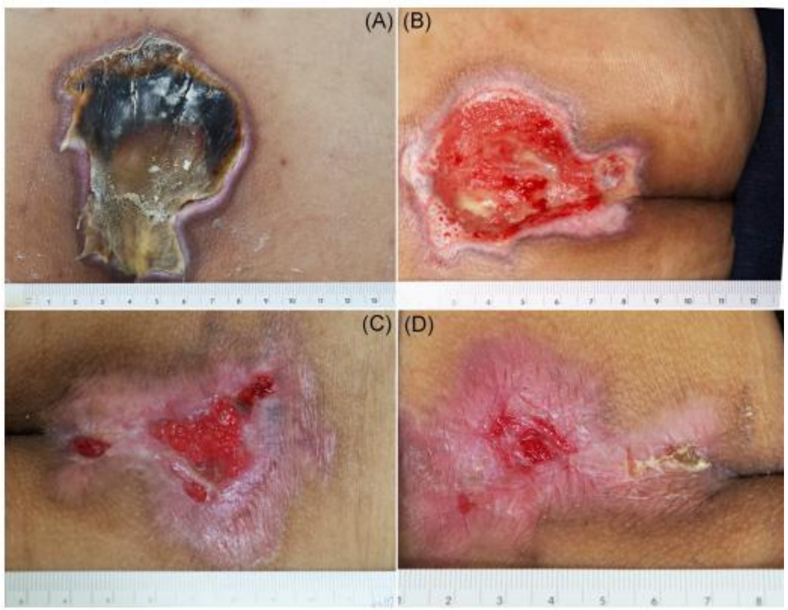

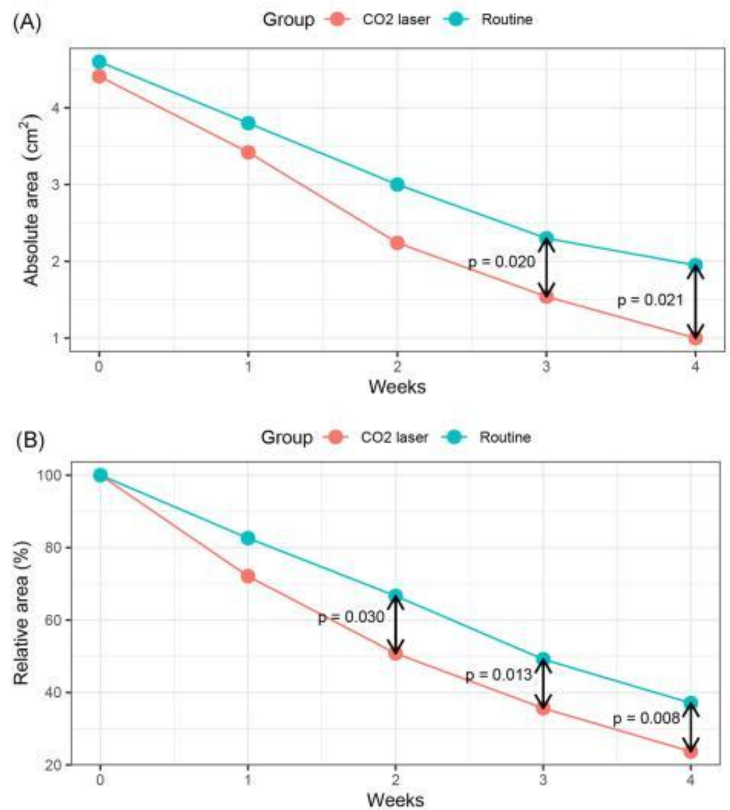

FIGURE 2 Comparison of absolute and relative wound area reductions during the observation period between two groups. (A) Showing median of absolute area, (B) percentage of unhealed area

CLINICAL REPORT

Efficacy and safety of CO_2 laser in the treatment of chronic wounds: A Retrospective Matched Cohort Trial

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FIGURE 5 Case. A 30-year-old female, with a body mass index (BMI) of 20, with primordial dwarfism, had a pressure ulcer on the left ischial tuberosity for >3 months. The wound healed 70 days after CO_2 laser treatment. (A) Before CO_2 laser treatment, large amounts of aging granulation tissues covered the wound. (B) immediate after CO_2 laser treatment. (C) 3 weeks after CO_2 laser treatment. (D) 6 weeks after CO_2 laser treatment

CLINICAL REPORT

Efficacy and safety of CO_2 laser in the treatment of chronic wounds: A Retrospective Matched Cohort Trial

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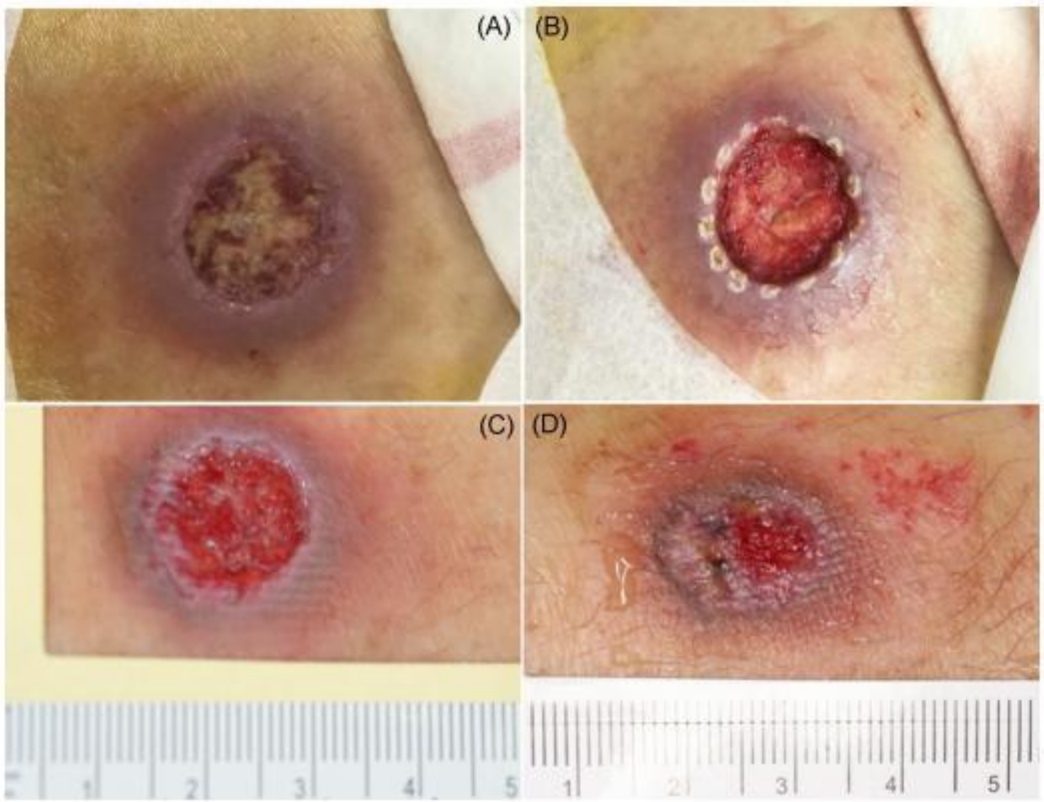

FIGURE 6 Case. A 30-year-old male, with a body mass index (BMI) of 24, no history of diabetes, had an infected wound in his right leg for >3 months. The infection was well controlled when he came to our hospital. The wound healed 35 days after CO_2 laser treatment. (A) Before CO_2 laser treatment. (B) Immediately after CO_2 laser treatment, laser drilling can be seen at the edge of the wound. (C) 2 weeks after CO_2 laser treatment. (D) 4 weeks after CO_2 laser treatment

The International Journal of Lower Extremity Wounds
1–5

DOI: 10.1177/1534734620953674
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SAGE

CO_2 Laser Debridement and Negative Pressure Wound Therapy With Endoscopic Support for Treatment of Sinus Wound at the Ischial Tuberosity: Case Report

JiaJun Tang, MD[1*], Guilu Tao, MD[1*], Yingkai Liu, MD[1], Xian Ma, MD[1], Yakupu Aobuliaximu, BS[1], and Shuliang Lu, MD[1]

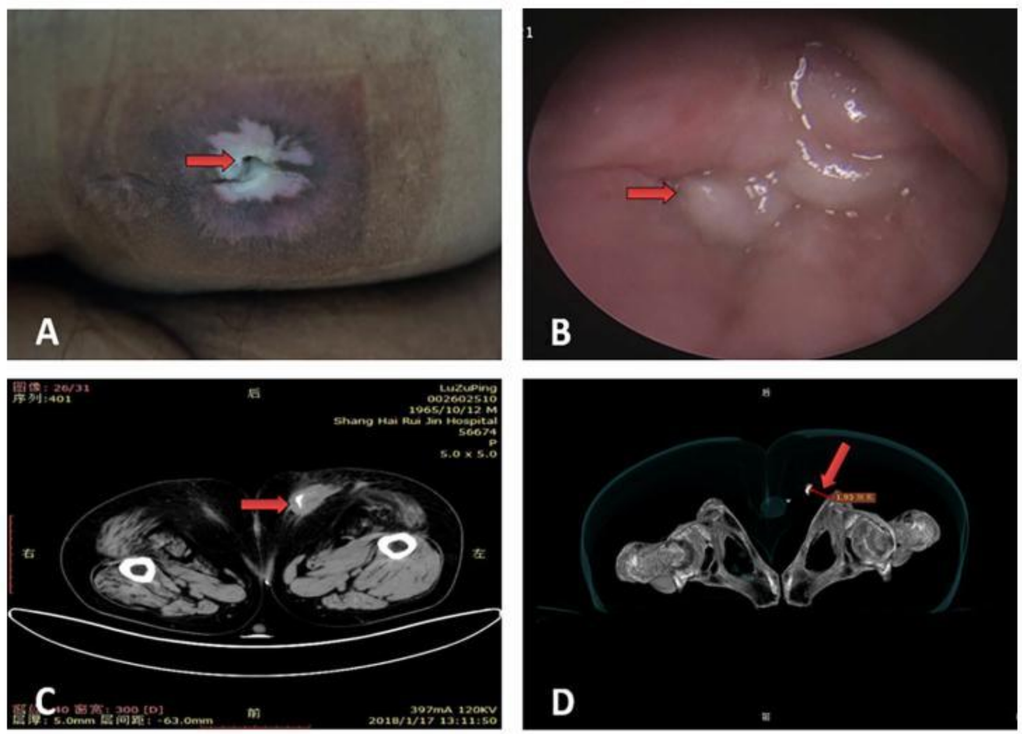

Figure 1. Wound examination. (A) External orifice of sinus wound (SW; red arrow) and (B) Fiber hyperplasia on sinus wall observed with endoscopic support (red arrow). (C) High-density contrast agent showing position of SW (red arrow). (D) The deepest part was ~1.93 cm from the left ischial tuberosity (red arrow).

CO_2 Laser Debridement and Negative Pressure Wound Therapy With Endoscopic Support for Treatment of Sinus Wound at the Ischial Tuberosity: Case Report

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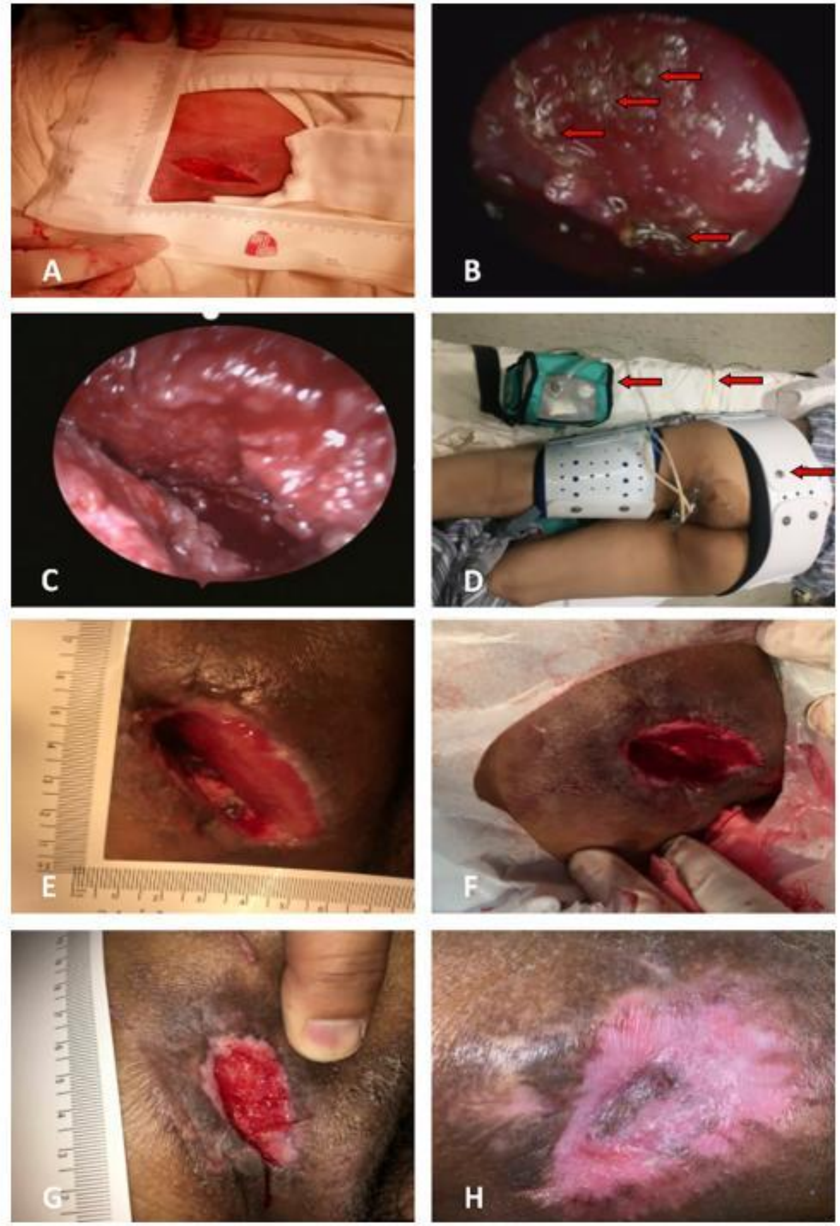

Figure 2. Wound treatment. (A) External appearance of sinus wound (SW) and (B) CO_2-affected tissue (red arrow). (C) Internal appearance after scraping of CO_2-affected tissue. (D) Hip bracing, catheter, and negative-pressure wound therapy. (E) External appearance of SW after 7 days. (F) External appearance of SW after 14 days. (G) External appearance of SW after 21 days. (H) External appearance of SW after 35 days.

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Others Treatments

Scleroderma

Lasers Med Sci
DOI 10.1007/s10103-016-2041-5

ORIGINAL ARTICLE

Fractional carbon dioxide laser versus low-dose UVA-1 phototherapy for treatment of localized scleroderma: a clinical and immunohistochemical randomized controlled study

S. M. Shalaby[1] · M. Bosseila[1] · M. M. Fawzy[1] · D. M. Abdel Halim[1] · S. S. Sayed[2] · R. S. H. M. Allam[3]

Morphea is a rare fibrosing skin disorder that occurs as a result of abnormal homogenized collagen synthesis. Fractional ablative laser resurfacing has been used effectively in scar treatment via abnormal collagen degradation and induction of healthy collagen synthesis. Therefore, fractional ablative laser can provide an effective modality in treatment of morphea. The study aimed at evaluating the efficacy of fractional carbon dioxide laser as a new modality for the treatment of localized scleroderma and to compare its results with the well-established method of UVA-1 phototherapy.

Seventeen patients with plaque and linear morphea were included in this parallel intra-individual comparative randomized controlled clinical trial. Each with two comparable morphea lesions that were randomly assigned to either 30 sessions of low-dose (30 J/cm2) UVA-1 phototherapy (340–400 nm) or 3 sessions of fractional CO2 laser (10,600 nm-power 25 W). The response to therapy was then evaluated clinically and histopathologically via validated scoring systems. Immunohistochemical analysis of TGF-ß1 and MMP1 was done. Patient satisfaction was also assessed. Wilcoxon signed rank test for paired (matched) samples and Spearman rank correlation equation were used as indicated. Comparing the two groups, there was an obvious improvement with fractional CO2 laser that was superior to that of low-dose UVA-1 phototherapy. Statistically, there was a significant difference in the clinical scores ($p = 0.001$), collagen homogenization scores ($p = 0.012$), and patient satisfaction scores ($p = 0.001$).

In conclusion, fractional carbon dioxide laser is a promising treatment modality for cases of localized morphea, with proved efficacy of this treatment on clinical and histopathological levels.

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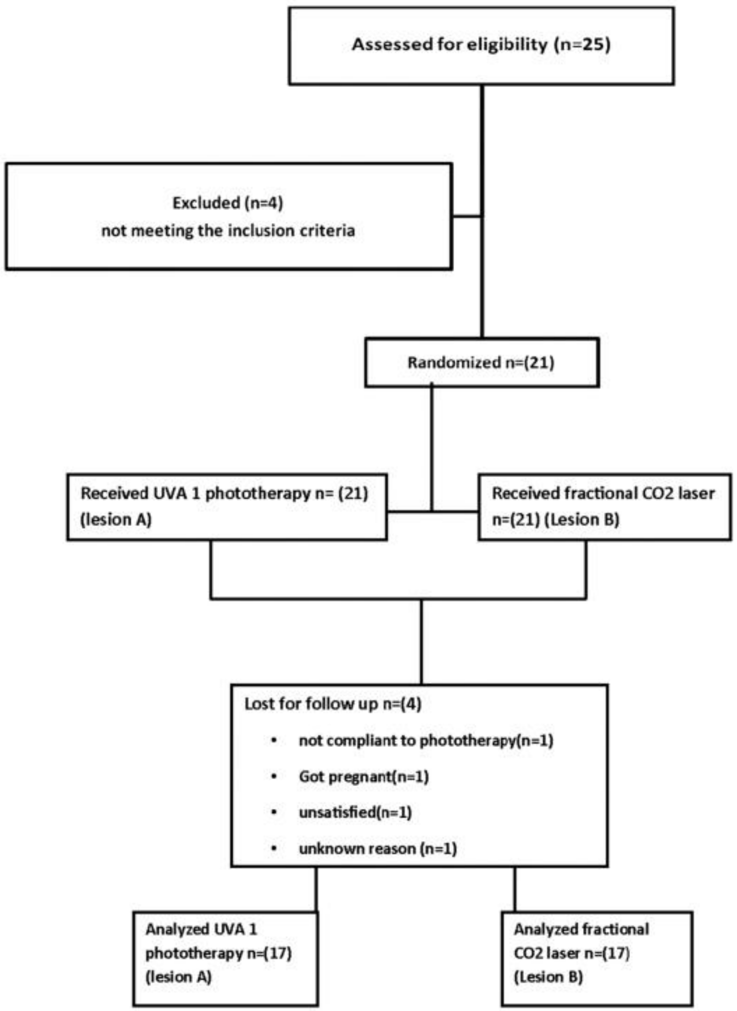

CO2 Laser

UVA-1 phototherapy

Fig. 2 Patient number 10:10 years old female with **a** plaque morphea lesion on the left thigh before laser treatment. **b** After fractional CO_2 laser treatment, showing excellent response with almost normalization of the skin, improvement as regards softening and dyschromia (score pretreatment: 9, score post-treatment: 1). **c** Linear morphea lesion on the right thigh before treatment. **d** After UVA-1 phototherapy (score pre-treatment: 9, score post-treatment: 4). Note the post-UVA-1 hyperpigmentation, giving impression of worsening of the condition in spite of evident softening by clinical evaluation

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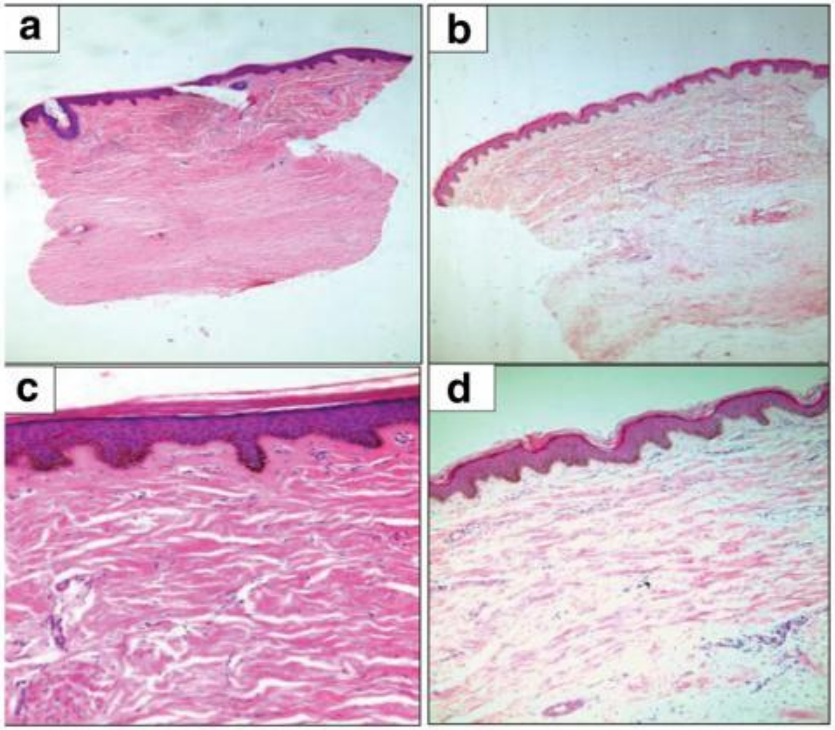

Fig. 3 Photomicrographs of skin sections obtained from patient number 8 who achieved marked clinical improvement. **a** Pretreatment biopsy (×40) square-shaped biopsy with marked homogenization of collagen. **b** Post-fractional CO_2 laser treatment biopsy (×40), showing thinning of the collagen fibers. **c** Pretreatment biopsy (×40) showing thickened homogenized collagen. **d** Post-UVA-1 phototherapy biopsy (×40), showing thinning of the collagen fibers

- Decrease in TGF-β1 values indicating the improvement of the fibrotic state
- Increase in MMP1 values indicating collagen degradation after treatment
- CO2 laser group showed better decreased dermal thickness than the UVA-1 group.
  Thickening of the dermis is a typical sign of this pathology

Evaluation method	Time of Evaluation	UVA-1 phototherapy Mean ± SD	Fractional CO_2 laser Mean ± SD	p value
Clinical score (unit) (LoSCAT)	Before EoS	6.24 ± 2.412 4.24 ± 1.921	6.53 ± 2.322 2.65 ± 1.73	0.001*
Patient satisfaction score after treatment (unit)	EoS	1.12 ± 0.06	2.24 ± 0.664	0.001*
Collagen homogenization scores (unit)	Before EoS	7.53 ± 1.94 5.41 ± 2.45	7.53 ± 1.94 3.71 ± 2.59	0.012*
TGF-ß1 (Mean area %)	Before EoS	2.52 ± 0.93 1.40 ± 0.82	2.97 ± 0.83 1.70 ± 0.96	0.795
MMP1 (Mean area %)	Before EoS	15.41 ± 4.07 32.88 ± 8.53	15.41 ± 4.48 33.17 ± 9.05	0.868
UBM dermal thickness (mm)	Before EoS	1.44 ± 0.29 1.06 ± 0.18	1.42 ± 0.29 0.91 ± 0.2	0.017*

*$P \leq 0.05$ (significant)

S.D standard deviation, *LoSCAT* localized scleroderma cutaneous assessment tool, *EoS* end of study, *TGF-ß1* transforming growth factor ß1, *MMP1* matrix metalloproteinase 1, *UBM* ultrasound biomicroscopy

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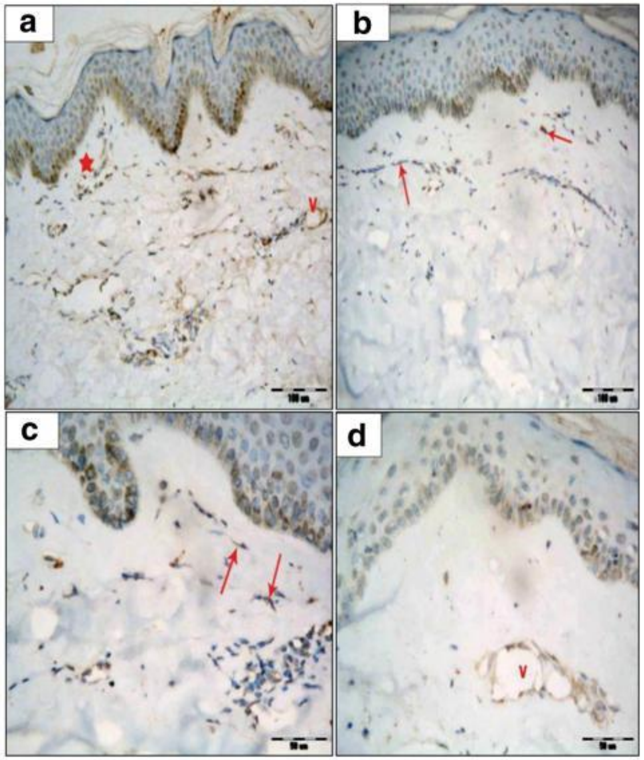

Fig. 4 Photomicrographs of skin sections obtained from patient number 10 who obtained very good clinical response. **a** Before treatment showing positive TGF-ß1 staining localized in the spindle-shaped fibroblasts, perivascular infiltrate (*star*) and endothelial lining of blood vessels. **b** After fractional CO_2 laser treatment with decrease in the area of positive staining limited to few fibroblasts (*arrow*) (TGF-ß1 immunohistochemistry, ×200). **c** Before treatment showing positive TGF-ß1 staining localized in the spindle-shaped fibroblasts (*arrows*) perivascular infiltrate and endothelial lining of blood vessels. **d** After UVA-1 treatment with decrease in the area of positive staining limited to endothelial lining of blood vessel (*v*) (TGF-ß1 immunohistochemistry, ×400)

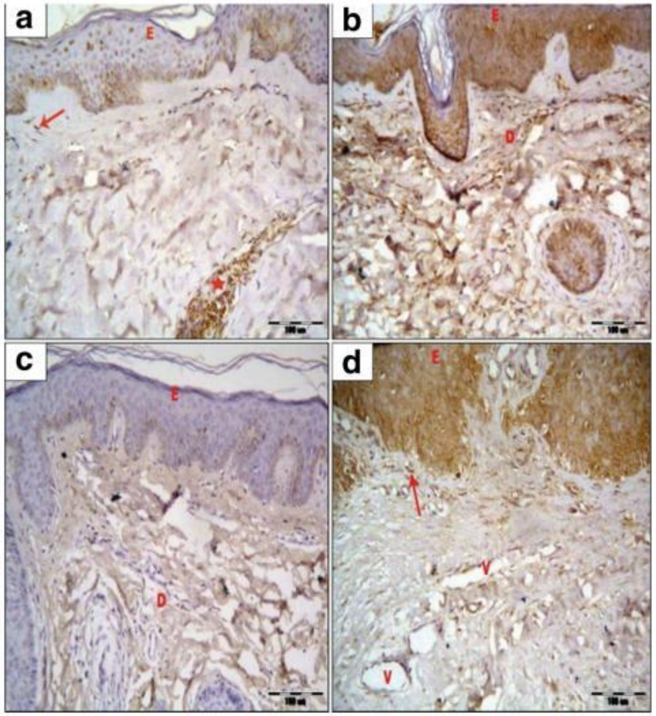

Fig. 5 Photomicrographs of sections obtained from patient number 10 who showed good clinical response. **a** Before treatment showing mild positive MMP1 staining localized in some epidermal keratinocytes, fibroblasts (*arrow*), extracellular matrix and endothelial lining of blood vessels (*star*). **b** After fractional CO_2 laser treatment with marked increase in the area of positive staining localizing to the epidermis (*E*), extracellular matrix (*D*), fibroblasts, and endothelial lining of blood vessels. **c** Before treatment showing mild positive MMP1 staining localized in extracellular matrix mainly (*D*). **d** After UVA-1 phototherapy with marked increase in the area of positive staining localizing to the epidermis (*E*), extracellular matrix, fibroblasts (*arrows*), and endothelial lining of blood vessels (*v*) (MMP1 immunohistochemistry, ×200)

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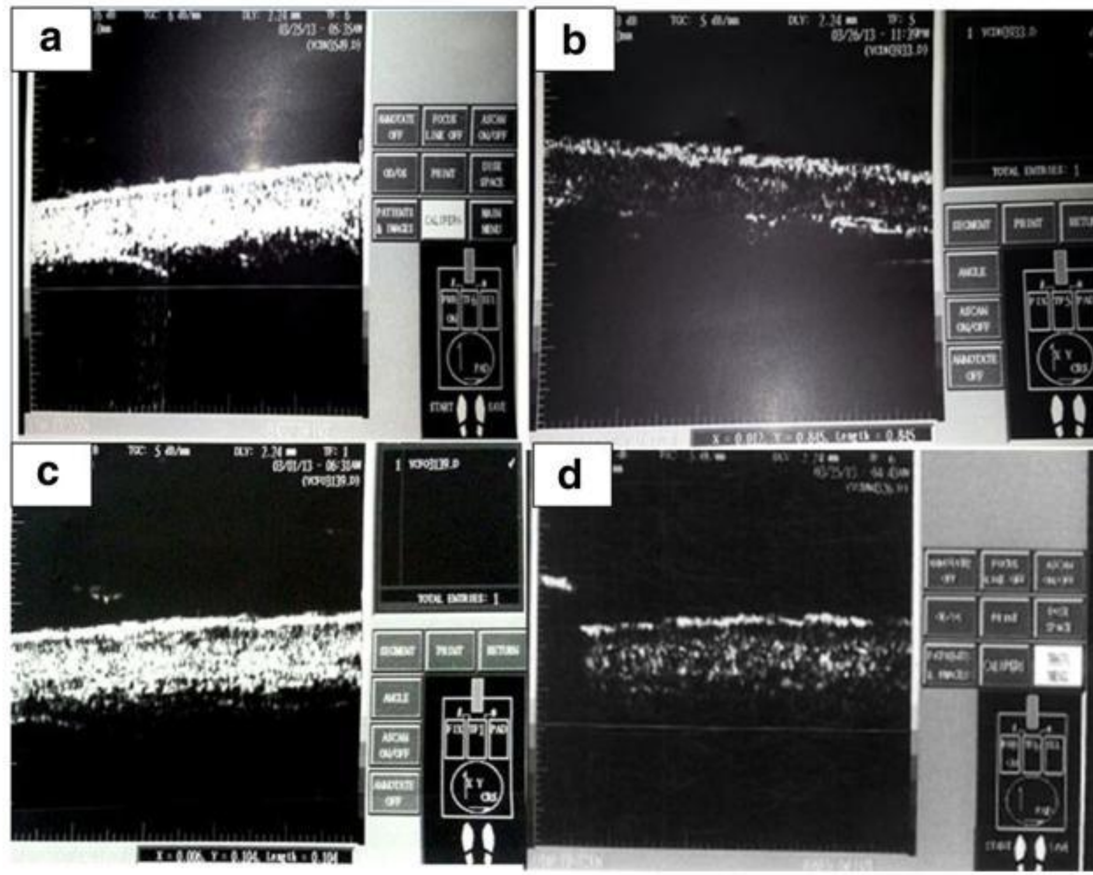

Fig. 6 Ultrasound biomicroscopy of morphea lesions of patient number 10 who showed clinical improvement. **a** Before treatment showing thickened dermis. **b** After fractional CO_2 laser showing marked decrease in dermal thickness indicative of the decrease collagen homogenization. **c** Before treatment showing thickened dermis. **d** After UVA-1 phototherapy showing marked decrease in dermal thickness indicative of the decrease collagen homogenization

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Others Treatments

Penile Lichen Sclerosus

Journal of Lasers in Medical Sciences
J Lasers Med Sci 2021;12:e61
Case Report
http://journals.sbmu.ac.ir/jlms
doi 10.34172/jlms.2021.61

Fractional Micro-ablative CO2 Laser as Therapy in Penile Lichen Sclerosus

Piero Campolmi[1], Giovanni Cannarozzo[2], Luigi Bennardo[3*], Alessandro Clementi[2], Mario Sannino[2], Steven Paul Nisticò[3]

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[2]Department of Dermatology, Tor Vergata University, Rome, Italy
[3]Department of Health Sciences, Unit of Dermatology, – Magna Graecia University, Catanzaro, Italy

Introduction: Topical steroids remain the first-line therapy to treat lichen sclerosus (LS), but circumcision may be curative in most cases. Positive results have been obtained by using a fractional micro-ablative CO2 laser to treat genital LS. This study aims to assess the safety and efficacy of the fractional micro-ablative CO2 laser in the treatment of penile LS.

Case Presentation: Five treatments with the fractional CO2 laser were performed on one 69-year-old man affected by penile LS. A significant improvement in symptomatology was noted after the first treatment session. Complete clinical remission was achieved 14 weeks after the last treatment.

Conclusion: The fractional micro-ablative CO2 laser may represent a practical therapeutic approach in penile LS.

Journal of Lasers in Medical Sciences

J Lasers Med Sci 2021;12:e61 Case Report

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doi 10.34172/jlms.2021.61

Fractional Micro-ablative CO2 Laser as Therapy in Penile Lichen Sclerosus

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Researchers applied a topical anesthetic cream for 1 hour in occlusive dressing to relieve the pain before each treatment.

Researchers carried out treatments using a fractional micro-ablative CO_2 laser (SmartXide2, DEKA, M.E.L.A, Florence, Italy). Parameters used were as follows: power, 10–13 W; spacing between dots, 500–600 µm; number of pulses on the same spot (stack), 1–2; emission mode, high pulse (HP). Researchers repeated the treatment until an excellent clinical and cosmetic result with a monthly interval.
Five sessions were necessary for a good outcome.

At the end of the procedure, an antibacterial ointment was applied to the treated surfaces twice a day for two weeks to favor reepithelization.

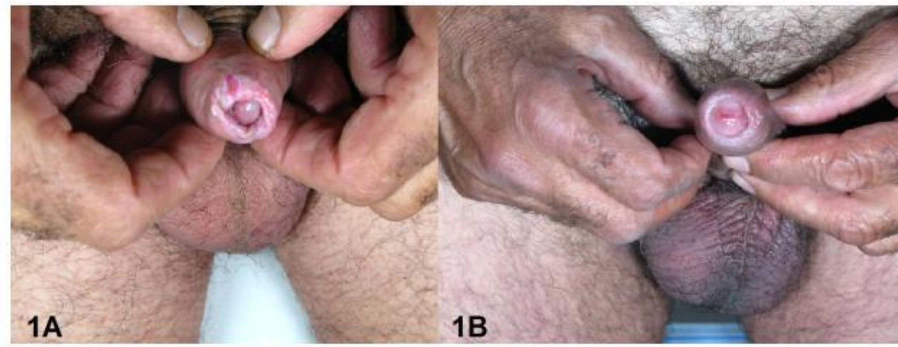

Figure 1. Penile Lichen Sclerosus Before (a) and After (b) Treatment.

Figure 2. Penile Lichen Sclerosus Before (a) and After (b) Treatment.

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Others Treatments

Actinic Cheilitis

Photobiomodulation, Photomedicine, and Laser Surgery
Volume 39, Number 4, 2021

Pp. 303–307
DOI: 10.1089/photob.2020.4853

Original Research—Case Report

Combination of Laser Therapy and Photodynamic Therapy with 5-Aminolevulinic Acid Patch for the Treatment of Actinic Cheilitis

Virginia Garofalo, MD,[1] Giovanni Cannarozzo, MD,[1] Ester Del Duca, MD,[1]
Mario Sannino, MD,[1] Sara Mazzilli, MD,[1] Annunziata Dattola, MD,[1] Steven Paul Nisticò,[2]
Elena Campione, PhD,[1] and Luca Bianchi[1]

Background: Actinic cheilitis (AC) is a premalignant lesion of the lips that can evolve into squamous cell carcinoma. Among nonsurgical treatments, photodynamic therapy (PDT) with 5-aminolevulinic acid (ALA) patch might represent a new noninvasive therapeutic approach for AC.

Objective: We sought to investigate the potential role of fractional CO2 laser pretreatment in boosting ALA penetration and distribution into AC treated with PDT.

Methods: We report a case of a woman with AC on the lower lip, treated with ablative fractional CO2 laser to boost drug delivery of 5-ALA patch before PDT treatment. Reflectance confocal microscopy was performed to assess diagnosis and treatment response.

Results: We detected a good clinical and cosmetic outcome after two applications of combined treatment. Erythema, crust, and edema were reported as side effects.

Conclusions: This case report shows that ablative fractional CO2 laser-assisted PDT might be an effective therapeutic alternative for patients with AC who refuse or are contraindicated for surgical procedures.

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Authors treated her with ablative fractional CO2 laser in combination with the conventional 5-ALA patch PDT.
Authors performed two sessions spaced 40 days apart.
Before each session, a 7-day course of acyclovir 800 mg was administered twice a day to prevent herpes viral infections.
The area was prepared with topical anesthesia with 5% prilocain–lidocain cream 1 h before the treatment. After anesthetic cream removal and skin disinfection, a laser session with SmartXide2 ablative fractional CO2 laser (DEKA-M.E.L.A, Calenzano, Italy) was performed.
Laser parameters were wavelength 10.600 nm, power 20 W, pulse width 100 µs, repetition rate 500 Hz, spot density 15 ·15 mm (328 spots/cm2), and beam size of 200 µm, resulting in a mild dermoabrasion of the lower lip. Immediately afterward, three 5-ALA patches (2 ·2 cm) were applied on the AC area of the lower lip without requiring additional occlusive dressing. After a 2-h incubation, the patches were removed and the Wood's lamp revealed an intensive and homogeneous fluorescence of the lower lip. The treated area was then irradiated with red light-emitting diode lamp (Aktilite 128 lamp; Galderma SA, Lausanne) with the peak emission at 632 nm and total light dose of 37 J/cm2 for 7 min.

FIG. 5. Clinical appearance at 6-month follow-up.

FIG. 4. Clinical appearance after 2 weeks of treatment. Side effects of the treatments include swelling erythema and crusts.

FIG. 6. Complete clearance at 12-month follow-up.

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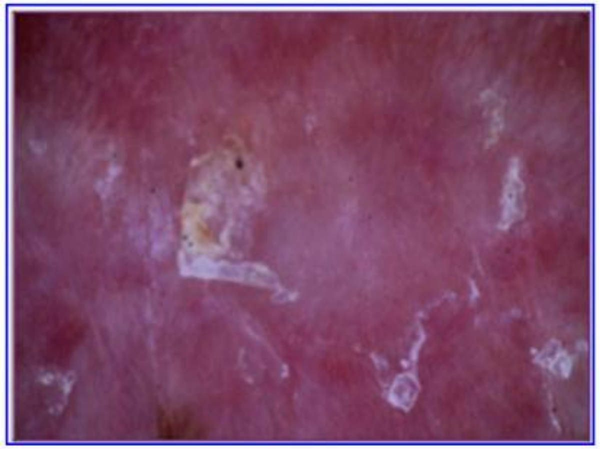


FIG. 2. Dermoscopic aspects of actinic cheilitis at baseline characterized by white structureless areas and scales.

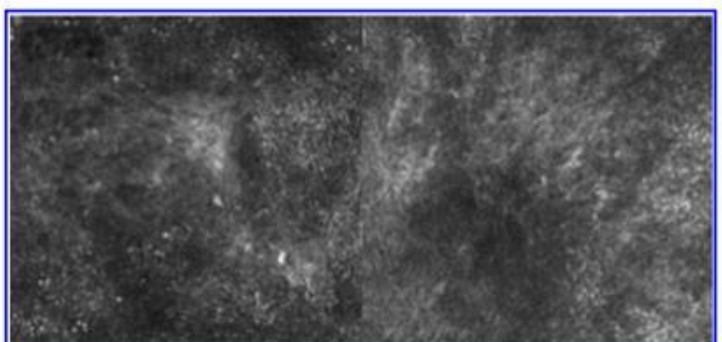


FIG. 3. RCM of actinic cheilitis revealed atypical honeycomb pattern with irregular cells size and shape, scales, and parakeratosis. RCM, reflectance confocal microscopy.

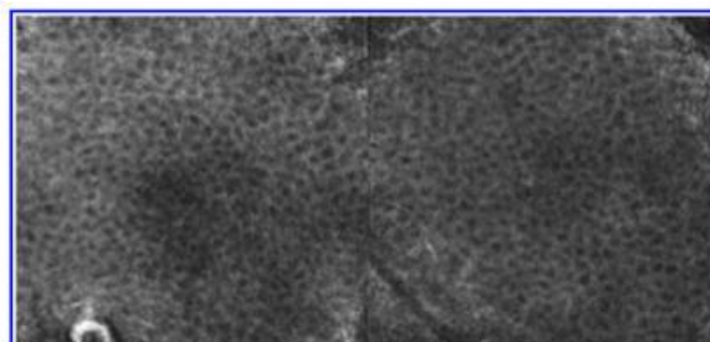
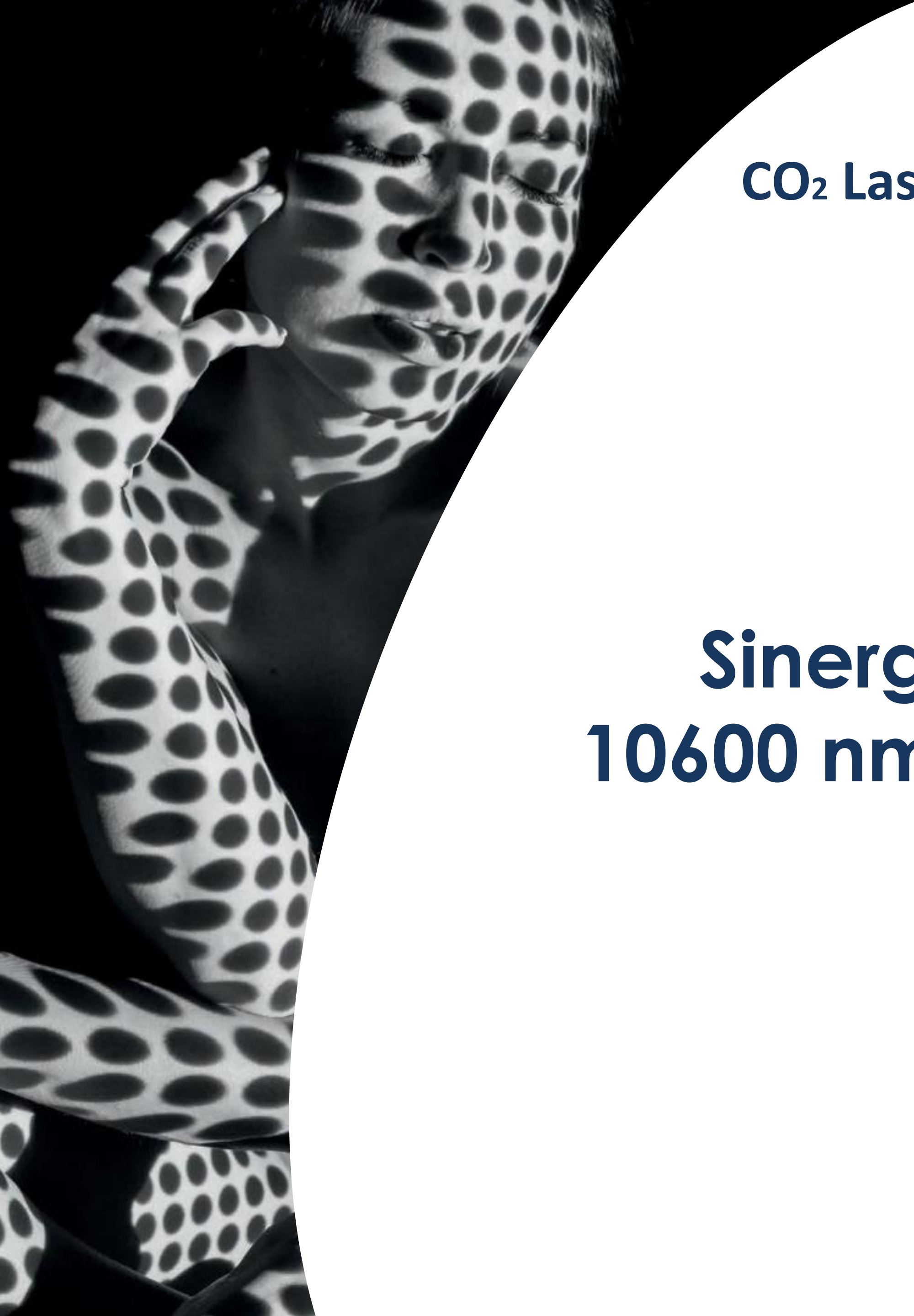


FIG. 7. RCM revealed complete recovery of the labial mucosa with honeycomb appearance of the epidermis at 12-month follow-up.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Sinergy between 10600 nm and 1540 nm

Pre-Clinical Data

medicina

MDPI

Article

Synergic sequential emission of fractional 10.600 and 1540 nm lasers for skin resurfacing: an ex-vivo histological evaluation.

Steven Paul Nisticò[1], Luigi Bennardo[1], Tiziano Zingoni [2], Laura Pieri [3], Irene Fusco [3*], Francesca Rossi[4], Giada Magni[4] and Giovanni Cannarozzo [2]

Background: Fractional ablative and non-ablative lasers are useful treatments for skin rejuvenation. A procedure that provides the sequential application of fractional ablative followed by non-ablative laser treatment may reduce patients' downtime and deliver better cosmetic results than with either laser alone.

Objective: The purpose of the current study was to demonstrate the ameliorative and therapeutic effects in skin remodeling of the synergistic use of the two laser wavelengths (fractional ablative CO2 and non-ablative 1540 nm) with three different types of pulse shapes, S-Pulse (SP), D-Pulse (DP) and H-Pulse (HP), through which the CO2 laser can emit, performing an ex vivo histological evaluation. Methods: In this prospective study, ex vivo sheep inner thigh skin was chosen due to its similarity to human skin tissue, and a histological evaluation was performed. Three irradiation conditions, using all of the three CO2 pulse shapes (alone or averaged), were investigated: 10.600 nm alone, the sequential irradiation of the two wavelengths in the same perfectly controlled energy pulses (DOT) for the entire scan area; ((2) 10.600 nm followed immediately by 1540 nm; and (3) 1540 nm followed immediately by 10.600 nm).

Results: When comparing ablative to sequential irradiations, the synergy of the two wavelengths did not alter the typical ablative pulse shape of the10.600 nm laser alone. With the same CO2 pulse shape, the lesion depth did not vary with the synergy of the two wavelengths, while thermal lesion width increased compared to CO2 alone. The ablation rate was achieved, while the total thermal lesion coverage in the scanning area of CO2 − 1540 lasers was greater than when using CO2 alone and then the other sequential irradiation.

Conclusions: This study provides important preclinical data for new and early uses of the novel 10.600/1540 nm dual-wavelength non-ablative fractional laser. The synergy of the two wavelengths enhanced all the benefits already available when using CO2 laser systems both in terms of tone strengthening, thanks to a greater shrinking effect, and in terms of stimulation and collagen remodeling thanks to a greater volumetric thermal effect.

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Article

Synergic sequential emission of fractional 10.600 and 1540 nm lasers for skin resurfacing: an ex-vivo histological evaluation.

Steven Paul Nisticò[1], Luigi Bennardo[1], Tiziano Zingoni [2], Laura Pieri [3], Irene Fusco [3*], Francesca Rossi[4] , Giada Magni[4] and Giovanni Cannarozzo [2]

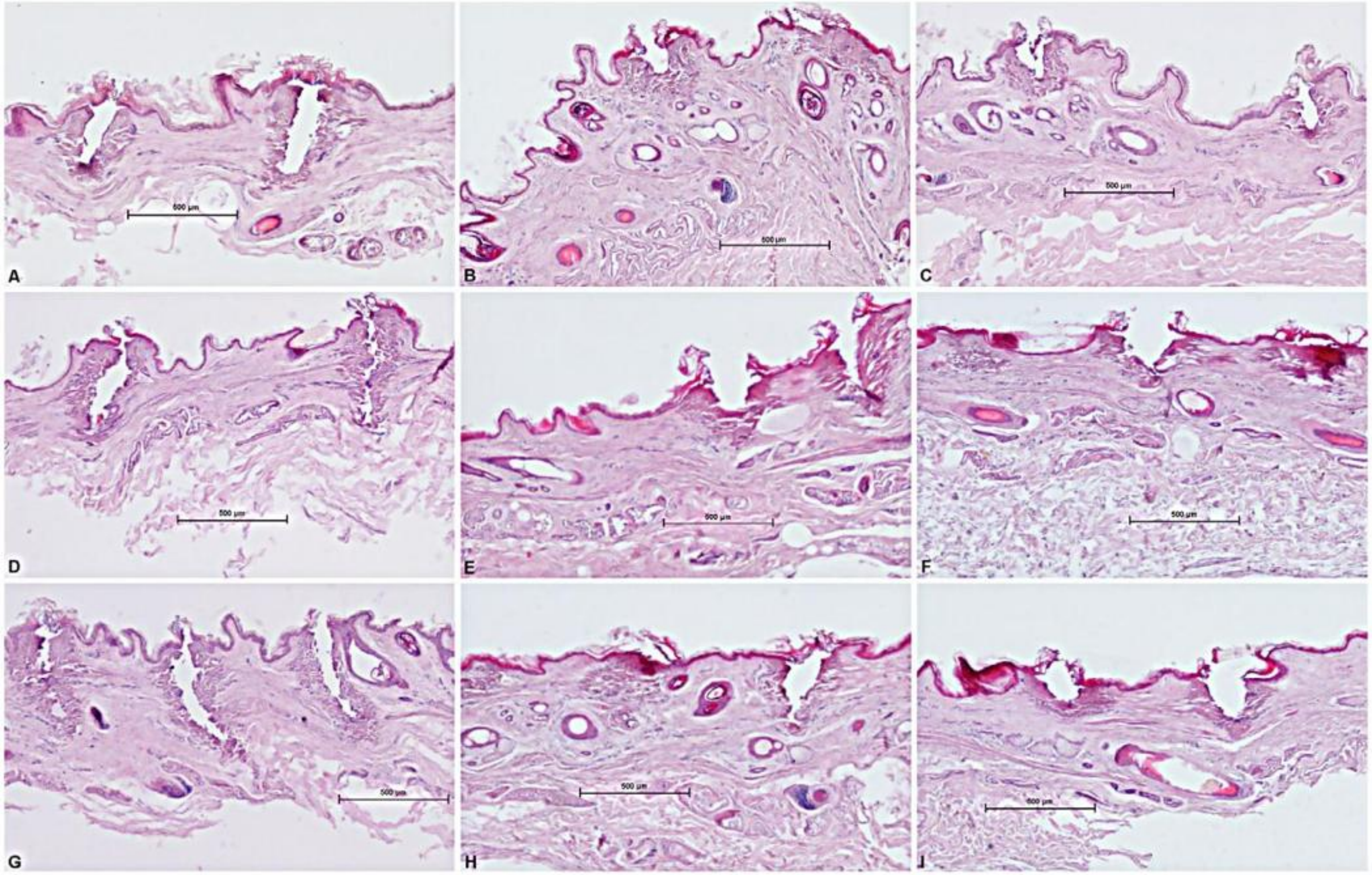

Figure 4. Histological outcomes in ex vivo sheep skin: top panel: only CO2 emission; middle panel: 10.600 nm and 1540 nm emissions and bottom: panel 1540 nm and 10.600 nm emissions.**(A,D,G)** H-Pulse; **(B,E,H)** S-Pulse; **(C,F,I)**; D-Pulse.

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Article

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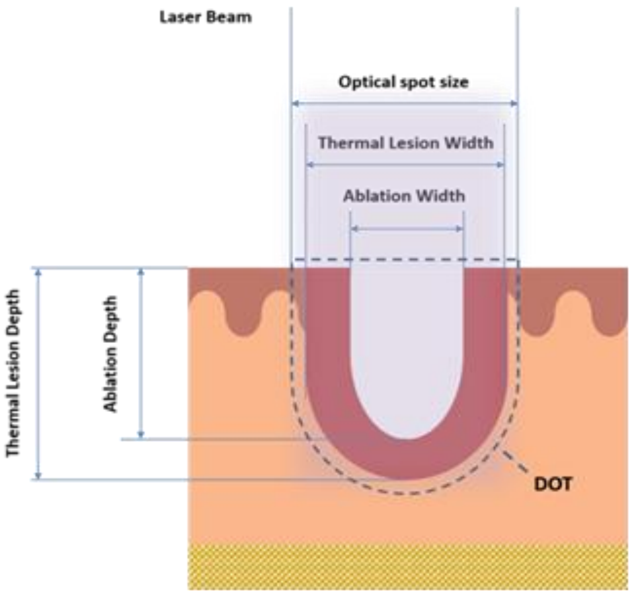

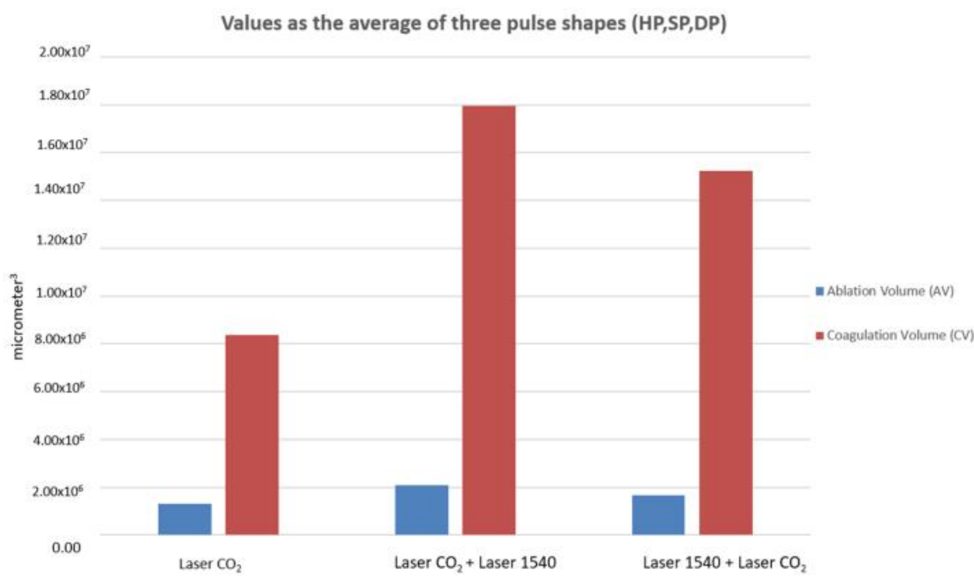

Figure 6. Graphic representation of ablation volume (AV) and coagulation volume (CV) for the three types of laser emissions calculated based on the average of the CO2 pulse shapes (HP, SP, DP)

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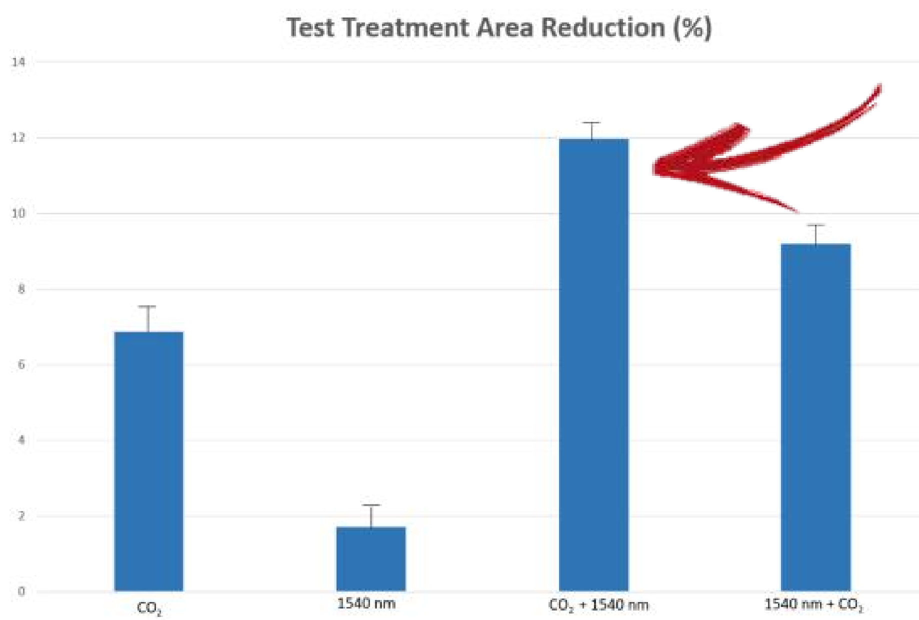

Greater shrinkage effect!

Figure 7. Percentage of reduction in the treatment area with different wavelengths and combinations of them. The combined use of the two wavelengths demonstrated a greater contraction effect on ex vivo skin.

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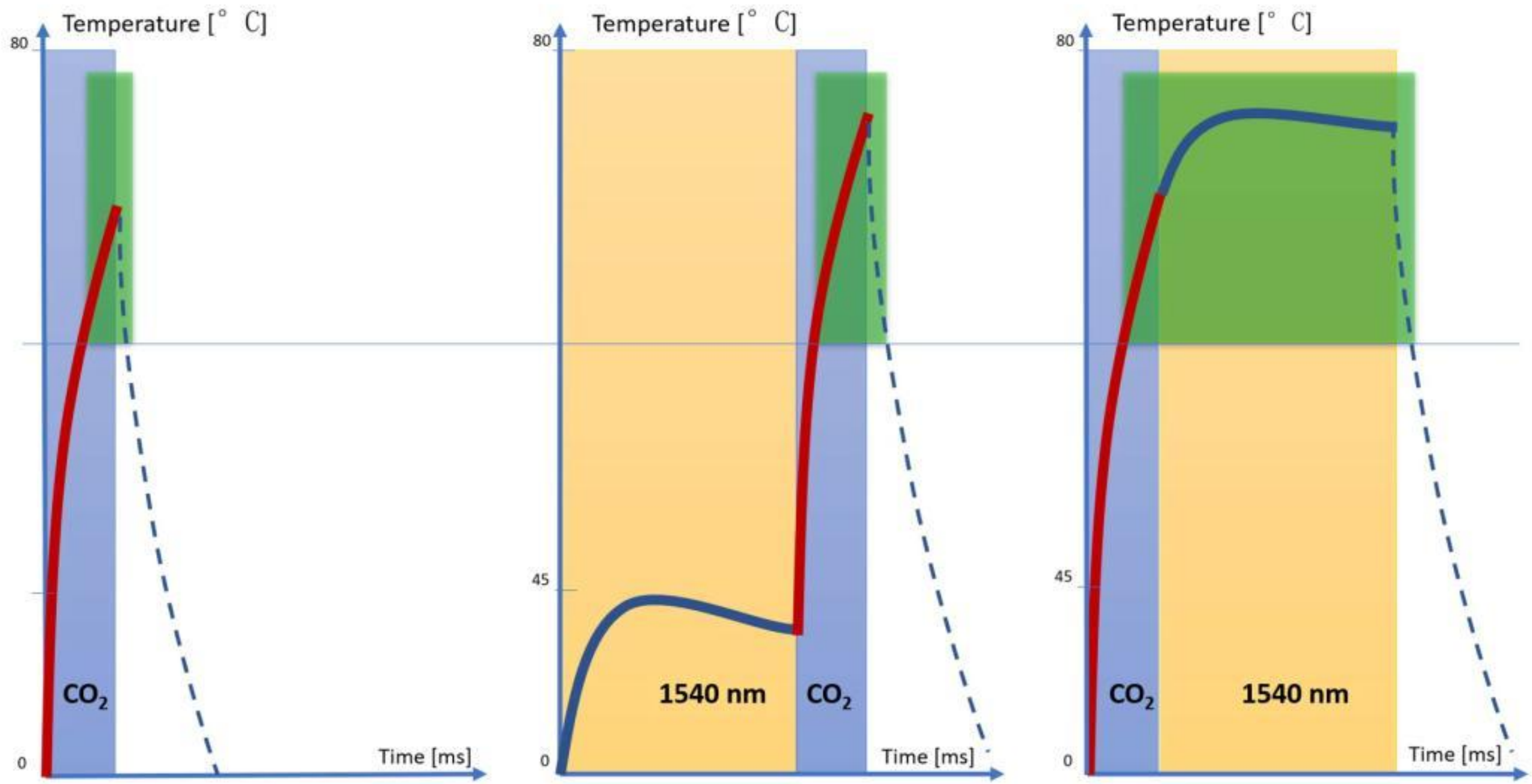

Figure 8. Qualitative graphic representation of denaturation volume of the different emissions interactions with tissue. (Temperature (◦C) range: 0–80; time (ms) range: 0–5). The 10.600–1540 nm sequence emission led to a greater coagulation effect and, therefore, greater shrinkage of the tissue.

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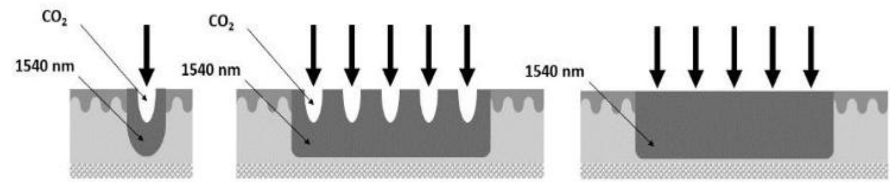
1540-nm fractional laser treatment modulates proliferation and neocollagenesis in cultured human dermal fibroblasts



Giada Magni[1], Domenico Piccolo[2], Paolo Bonan[3], Claudio Conforti[4], Giuliana Crisman[2], Laura Pieri[5], Irene Fusco[5]* and Francesca Rossi[1]

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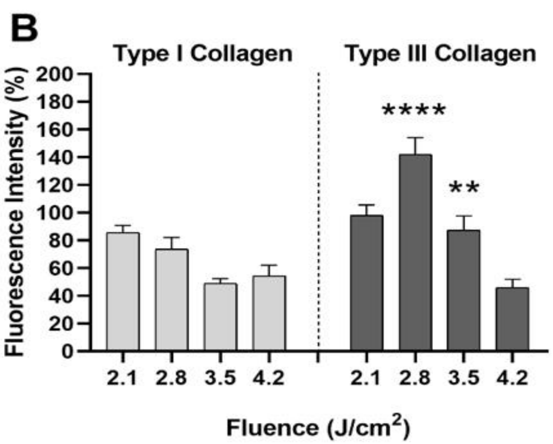

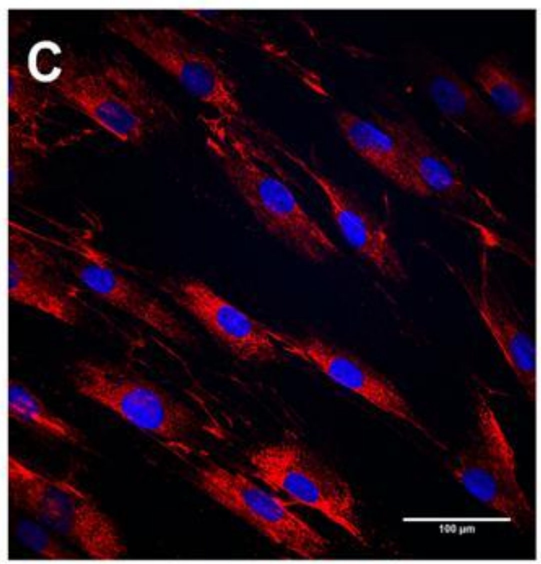

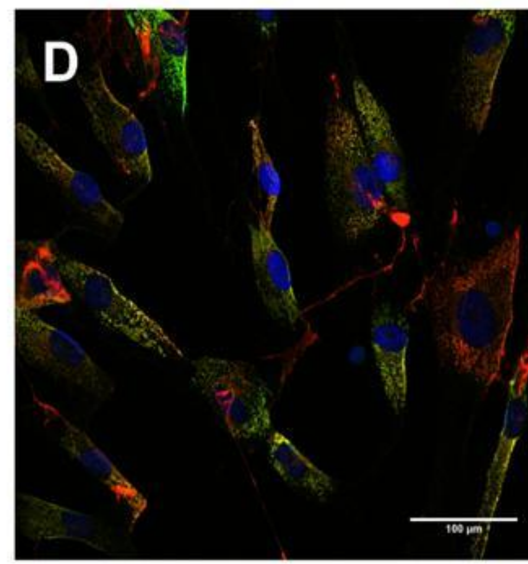

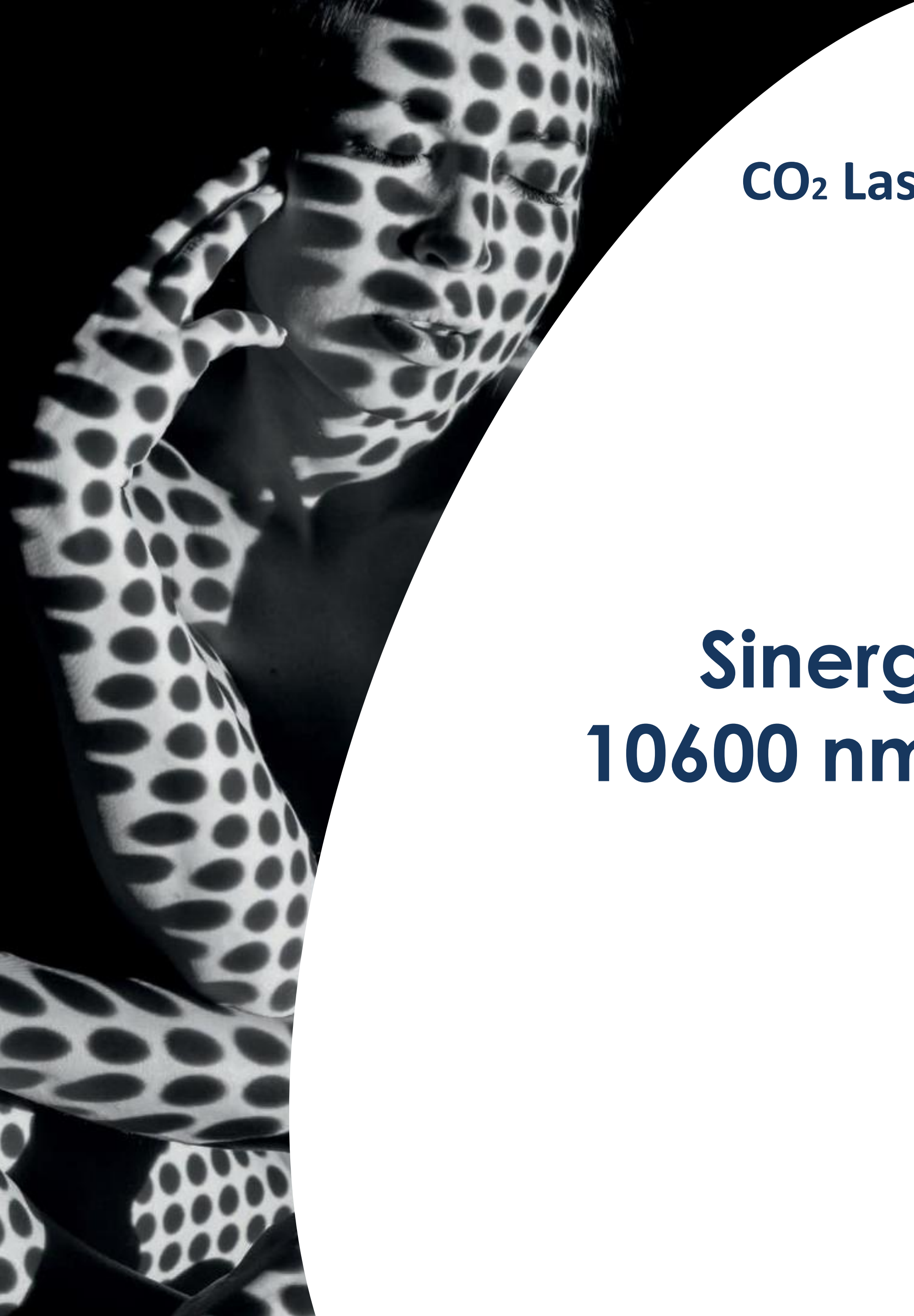

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Sinergy between 10600 nm and 1540 nm

Skin laxity and Skin Rejuvenation

medicina

MDPI

Communication

Laser Impacts on Skin Rejuvenation: The Use of a Synergistic Emission of CO_2 and 1540 nm Wavelengths

Stefania Belletti [1], Francesca Madeddu [2], Antonino Brando [3], Eugenio Provenzano [4], Steven Paul Nisticò [5], Irene Fusco [2,*] and Luigi Bennardo [6]

Abstract: Background and Objectives: For nearly 15 years, carbon dioxide (CO2) laser has been the gold standard in skin rejuvenation.

Aim: The purpose of this study was to assess the efficacy of a new laser device which combines CO2 and 1540 nm wavelengths in wrinkles reduction, using a recently developed scanning unit named the µScan DOT scanner. Materials and Methods: A total of 20 female patients underwent from two to four laser treatment sessions performed once every 45–90 days. Wrinkles reduction was evaluated using the Fitzpatrick Wrinkle Classification System (FWCS). Evaluations of five-point Global Patient's Assessment (PGA) and an Oedema and Erythema index based on a four-point scale were carried out. A careful photographic evaluation was performed to observe the patients' aesthetic improvements. All the assessments were performed before and at 3 months follow up (3 MFU) after the last treatment session.

Results: The mean FWCS score significantly ($p < 0.01$) decreased from 5.45 ± 2.21 at baseline to 3.3 ± 1.78 at 3 MFU after the last treatment session. In total, 8/20 (40%) subjects reported excellent improvement, 7/20 (35%) subjects showed good improvement, 5/20 (25%) subjects showed slight improvement, and 0/20 (0%) subjects showed no improvement. Concerning the Oedema index, 15/20 subjects experienced a mild one, 5/20 subjects experienced a moderate one, and none of 20 experienced a severe one, while for the Erythema index, 1/20 patients experienced mild, 18/20 patients experienced moderate, and only 1/20 patient experienced severe erythema. No severe adverse events were observed.

Conclusions: This dual-wavelength laser technique may become a promising new option for safe, nonsurgical improvement for skin rejuvenation with an extremely low risk of scarring or hypopigmentation and shorter healing times.

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Communication

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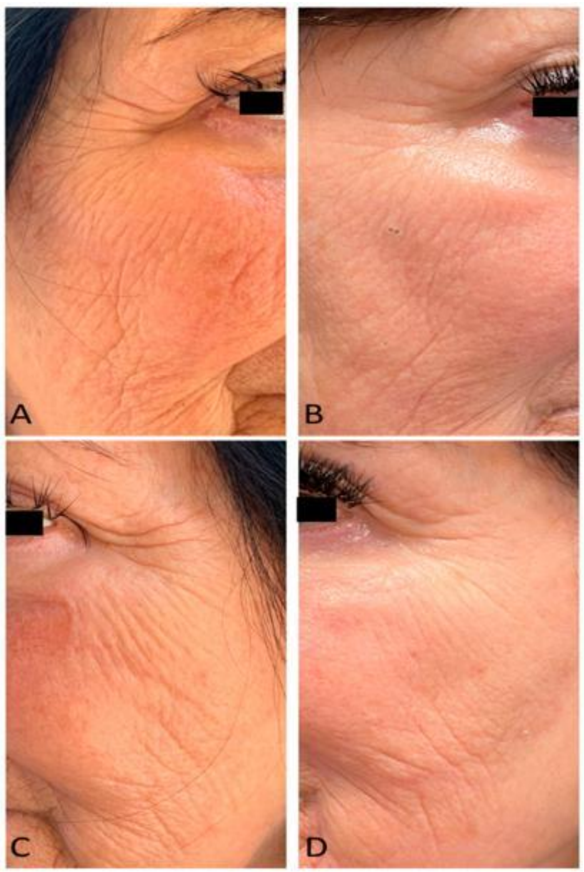
Stefania Belletti [1], Francesca Madeddu [2], Antonino Brando [3], Eugenio Provenzano [4], Steven Paul Nisticò [5], Irene Fusco [2,*] and Luigi Bennardo [6]



The laser parameters for the CO2 wavelength source were: DP pulse, spacing between DOTs of 500–700 µm, stack 1–2, and energy/DOT 22.6–54.4 mJ, while, for the 1540 nm source, the energy/DOT was 15–20 mJ.

The patients underwent 2–4 treatment sessions, and the treatments were performed once every 45–90 days.

Figure 1. Right lateral view of a female patient's face before (**A**) and after 4 laser treatments (3 MFU after the last treatment session) (**B**). Left lateral view of a female patient's face before (**C**) and after 4 laser treatments (3 MFU after the last treatment session) (**D**).

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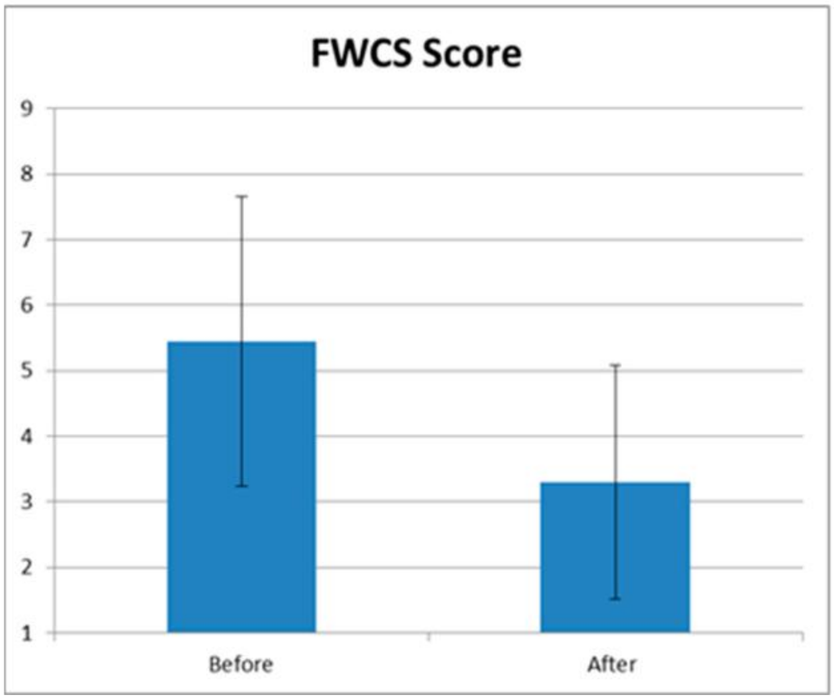

Figure 2. Graphical representation of mean FWCS score before and at 3 months follow-up (3 MFU) after the last treatment session. A statistically significant improvement can be seen ($p<0.01$)

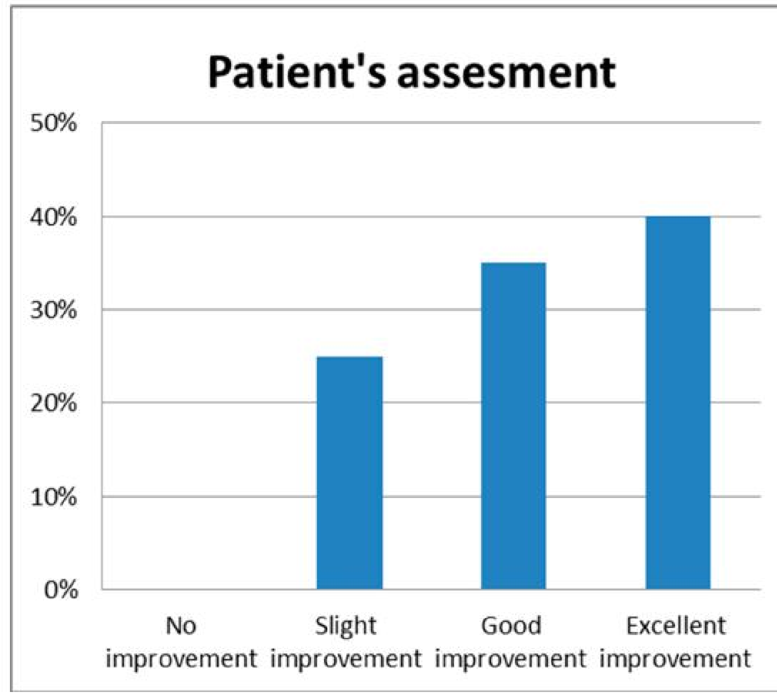

Figure 3. Histogram representation of Patients Assessment values at 3 months follow-up (3 MFU) after the last treatment session.

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Communication

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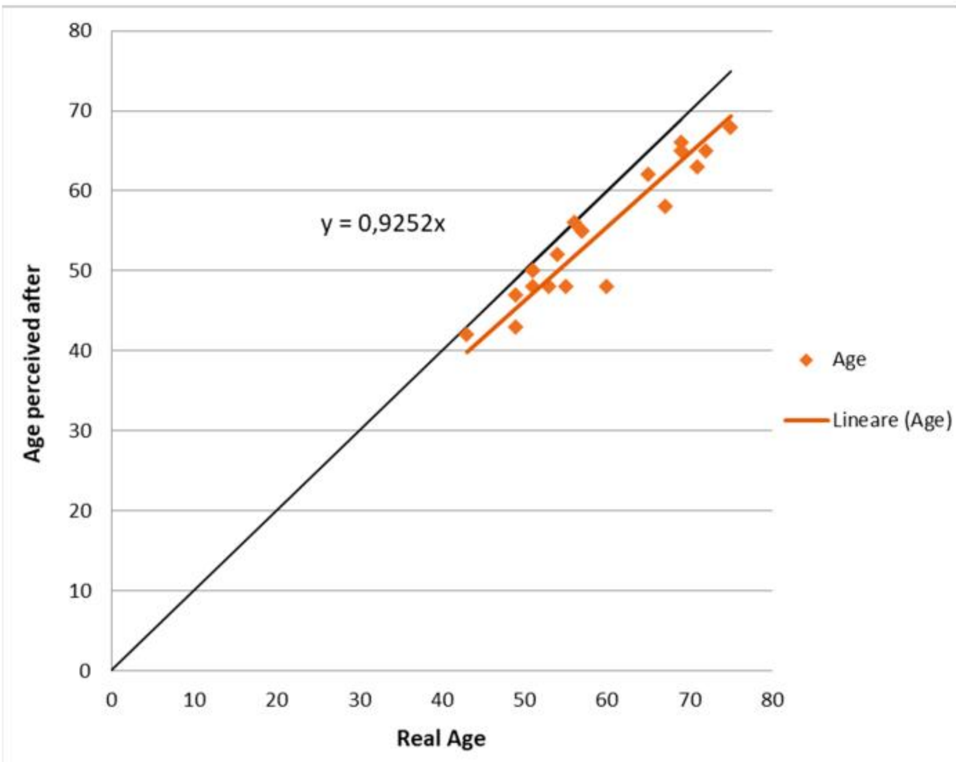

Figure 4. Plot of the trend's values of perceived age of patients after laser treatment (the continuous line is the bisector, while the rhomboid dots are the perceived age of patients).

An independent dermatologist also assigned an age to each patient based on the photos taken at follow-up, and the mean difference between the patient's perceived age at follow-up: real age was −4.3 ± 3.2 years ($p < 0.01$).

If patients looked their real age, the points on the graph would be on the bisector (black continuous line), whereas, if the patients looked older after the treatment, the points would be above the bisector. What can be seen from the graph, however, is that **the points are almost all below the black line, thus showing a high treatment efficacy**

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LETTER

WILEY

A sequential CO_2 and 1540 nm laser for the treatment of neck skin laxity

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[1] Studio Kalos, Milano, Italy
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FIGURE 2: Sequential dual-wavelength-laser treatment for a 73-year-old woman patient. A comparison between the baseline (before treatment) and after 3 months of follow-up is shown. She underwent 3 sessions at 45-day intervals.

Patients underwent 3 sessions of treatment at 45-day intervals. In addition, the days necessary for the expulsion of the fibrin plugs and the patient's downtime were monitored to evaluate skin recovery.

For the treatment protocol we used, for the CO2 wavelength source was set Energy/DOT of 26 mJ, while for the 1540 nm source an Energy/DOT of 10 mJ.

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LETTER

WILEY

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A sequential CO_2 and 1540 nm laser for the treatment of neck skin laxity

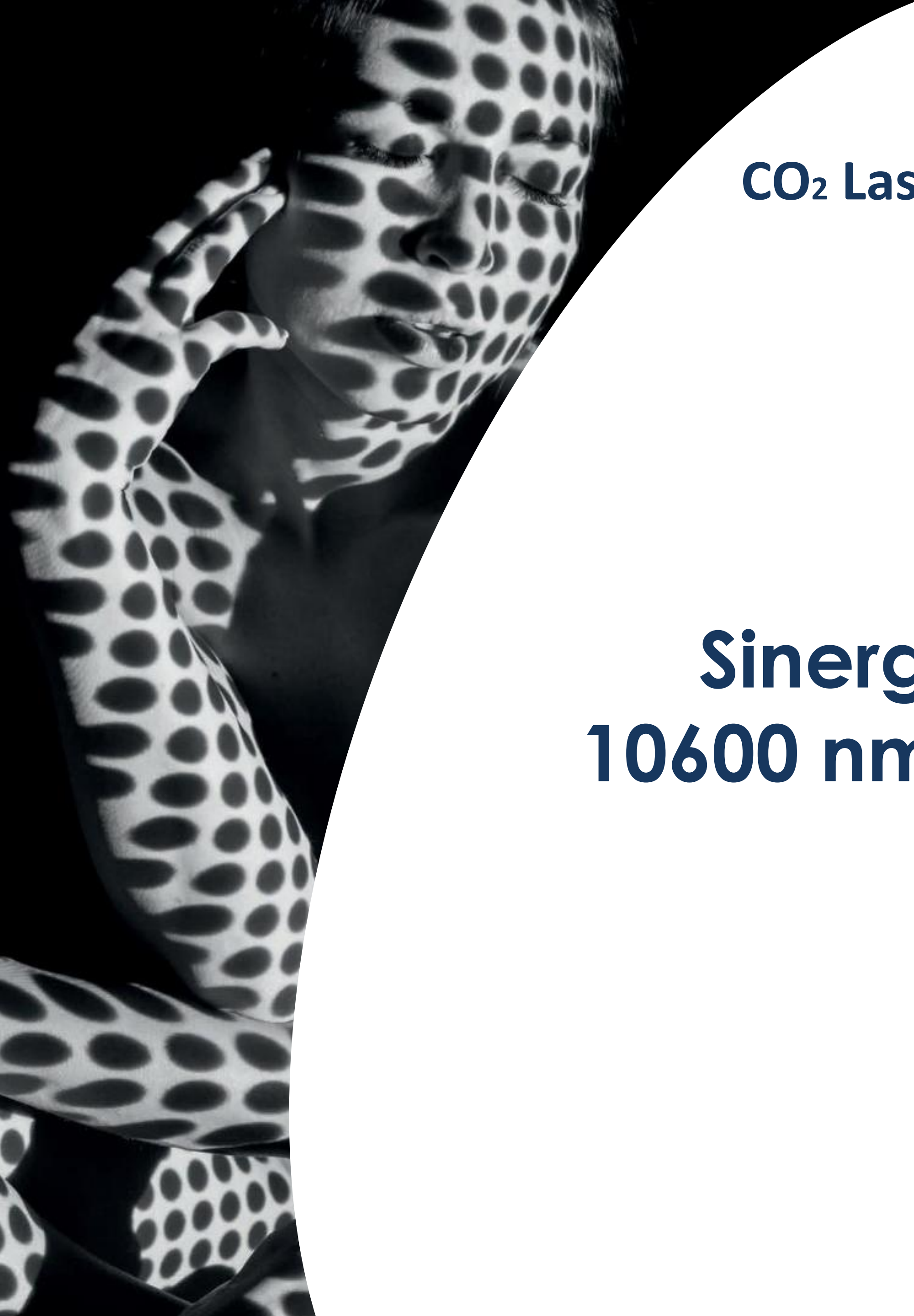
FIGURE 1 Sequential dual-wavelength-laser treatment for a 72-year-old woman patient. A comparison between the baseline (before treatment) and after 3 months of follow-up is shown. She underwent 3 sessions at 45-day intervals.

The **mean patient's downtime** was 5 to 6 days and the average days required for **expulsion of fibrin plugs** were 5 to 6 days as well.

Patients were asked to self-evaluate the result of the treatment with a **4-point Global Aesthetic Improvement Scale (GAIS)** (None-0, Slight-1, Mild-2, Excellent-3) and all of them agreed on an 'excellent' outcome.

Indeed, the **mean difference between the perceived age by the patients after treatment and the real age** was – 6/7 years.

The **Fitzpatrick Wrinkle Classification System (FWCS)** was used by the physician to assess patients' clinical improvement considering a scoring system where 0 means no wrinkles and 9 deep and numerous wrinkles. For the 72-year-old woman, it decreased from 8 before treatment to 4 after 3 months of follow-up.
For the other patient (73 years old), it went from 6 before treatment to 3 after 3 months of follow-up.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Sinergy between 10600 nm and 1540 nm

Post-Surgical Scars

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Synergistic Sequential Emission of Fractional 1540 nm and 10 600 Lasers for Abdominal Postsurgical Scar Management: A Clinical Case Report

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Objective: Rare coexistence of disease or pathology

Background: Abdominal scars can develop following abdominoplasty interventions and can cause severe functional and aesthetic disabilities. Surgery is almost no longer necessary thanks to the accessibility of more recent and sophisticated technology like lasers. Many ablative and non-ablative photothermolysis technologies and equipment have been developed, giving patients and medical professionals more alternatives but also complicating the system to be utilized and the methods to maximize the outcomes. The aim of the current study was to evaluate the volumetric action of 1540 wavelength and the efficacy and safety of the synergic sequential application of a new fractional ablative 10 600 nm CO2 and non-ablative 1540 nm lasers on abdominal postsurgical scar management.

Case Report: We treated a female patient with an abdominal suprapubic scar following abdominoplasty. The patient underwent 3 treatment sessions (with a frequency of 1 session every 50 days) with 1 pass over the entire suprapubic area using 10 600 nm CO2 fractional laser emission and 1540 fractional laser emission in simultaneous modality. A photographic evaluation was made to monitor the effect of the treatment on the aesthetic appearance of the patient's suprapubic scar. After 6 months, the photographic assessment showed a significant improvement in scar texture and color. No patient pain or adverse effects were detected.

Conclusions: This case report describes the possibility of effectively treating abdominal suprapubic scars following abdominoplasty surgery with simultaneous and combined irradiation of 10 600 nm and 1540 nm wavelengths.

Figure 1. Aesthetic improvement of the patient's suprapubic abdominal scar before (A) and 60 days after the last treatment session (B) (6-month follow-up).

Utilizing the **1540+CO2 sequence**, 1 pass across the whole suprapubic region is made, and both wavelength simultaneously affect the skin.

For 10600 nm wavelength: Power 16W, pulse width of 1 ms, and stack 2 and 500 µm of spacing.

For 1540 nm wavelength: Power of 3W, pulse width of 5 ms and stack 2.

Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Sinergy between 10600 nm and 1540 nm

Burn Scars

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A Multimodal Approach to Laser Treatment of Extensive Hypertrophic Burn Scar: A Case Report

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Objective: Management of emergency care

Background: Hypertrophic scars from severe burns cause physical and psychological stress. Proper treatment, including CO2 laser systems, can alleviate these burdens by enabling skin remodeling and collagen production. This study assessed the efficacy of a new laser device with 2 wavelengths (10 600 nm/1540 nm) and 2 scanning units on hypertrophic burn scar management.

Case Report: A 34-year-old African woman sought treatment for a large hypertrophic burn scar on her right foot. The scar, formed at age 9, was complicated by infection. She underwent 2 CO2 sessions (Scar3 scanner), followed by 3 cycles of fractional CO2 +1540 nm laser (µScan DOT scanner) once a month, combined with topical hyaluronic acid. She also had 2 maintenance sessions with a 595-nm dye laser to prevent scar reactivation. The CO2 and 1540 nm laser synergy improved laxity through volumetric thermal effects, causing contraction and stimulation. This led to a softer, smaller scar with less consistency. The patient experienced significant improvement in quality of life due to alleviation of pain and restored footwear comfort.

Conclusions: The hypertrophic burn scar was effectively treated using 10 600 nm and 1540 nm wavelengths, along with dye
laser treatment for recurrence prevention.

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A Multimodal Approach to Laser Treatment of Extensive Hypertrophic Burn Scar: A Case Report

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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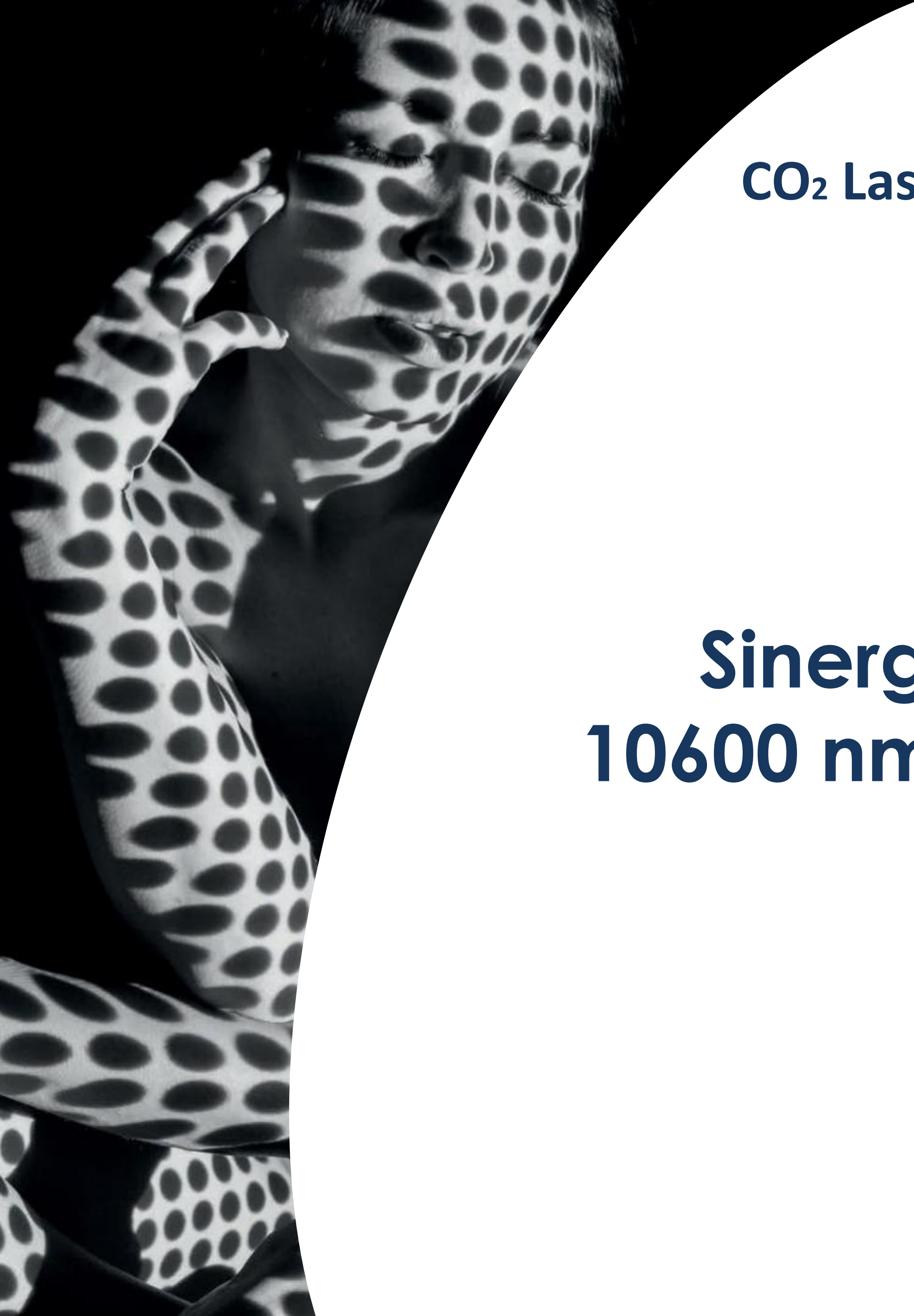
Figure 1. (A) Hypertrophic burn scar before laser treatment. **(B)** Hypertrophic scar after CO2 laser treatment (with Scar3 scanner) at 2 months from the beginning of treatment. **(C)** Hypertrophic burn scar after multiple cycles of synergic emission of 1540 nm and fractional CO2 laser (with μScan DOT scanner) at 3-month follow-up.

Figure :

(A) Hypertrophic burn scar before laser treatment.

(B) Hypertrophic scar after CO_2 laser treatment (with Scar3 scanner) and after multiple cycles of synergic emission of 1540 nm and fractional CO_2 laser (with µScan DOT scanner) at 3-month follow-up.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Sinergy between 10600 nm and 1540 nm

Acne Scars

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Communication

An Innovative Dual-Wavelength Laser Technique for Atrophic Acne Scar Management: A Pilot Study

Stefania Belletti [1], Francesca Madeddu [2], Giuseppe Fabrizio Amoruso [3], Eugenio Provenzano [4], Steven Paul Nisticò [5], Irene Fusco [2,*] and Luigi Bennardo [6]

Background and Objectives: Acne scars are one of the most disturbing and long-term symptoms of acne vulgaris, having a negative impact on a person's physical, emotional, and social well-being.

Aim: the purpose of the study was to evaluate the efficacy and post-treatment outcomes of a dual-wavelength system combining the irradiation of two wavelengths at 10,600 nm and 1540 nm in the management of facial atrophic acne scars.

Materials and Methods: Four healthy adult volunteers aged 24–53 years were enrolled. The areas treated were the full face (two patients), cheeks (one patient), and forehead (one patient). A dual-wavelength system (1540 nm and 10,600 nm) was used for this study. Patients underwent 2–4 treatment sessions, and the treatments were performed once every 45–90 days. All possible side effects such as burning sensation, dyschromia, mild to moderate post-treatment erythema, bleeding, itching, edema, and crusting were checked. The index to assess edema and erythema was based on a four-point scale (none, mild, moderate, and severe) and was applied before and at 3-month follow-up (3 MFU) after the last treatment session. In addition, a patient assessment was conducted before treatment and at 3 MFU after the last treatment session.

Results: For all patients examined, the edema index was mild, while for the erythema index, 3/4 patients experienced moderate and 1/4 patients experienced mild symptoms. The mean patient downtime was 5.8 ±0.5 days. Concerning the patient assessment, 2/4 subjects showed excellent improvement, 1/4 patients showed good improvement, and 1/4 patients showed slight improvement.
As shown by the photographic assessment, a noticeable improvement in skin texture and a substantial reduction in acne scars were observed at the end of treatment. Conclusions: This dual-wavelength laser technology has the potential to be an interesting and safe approach for acne scar treatment, with a low risk of scarring/hypopigmentation and a shorter healing time.

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Communication

An Innovative Dual-Wavelength Laser Technique for Atrophic Acne Scar Management: A Pilot Study

Stefania Belletti [1], Francesca Madeddu [2], Giuseppe Fabrizio Amoruso [3], Eugenio Provenzano [4], Steven Paul Nisticò [5], Irene Fusco [2,*] and Luigi Bennardo [6]

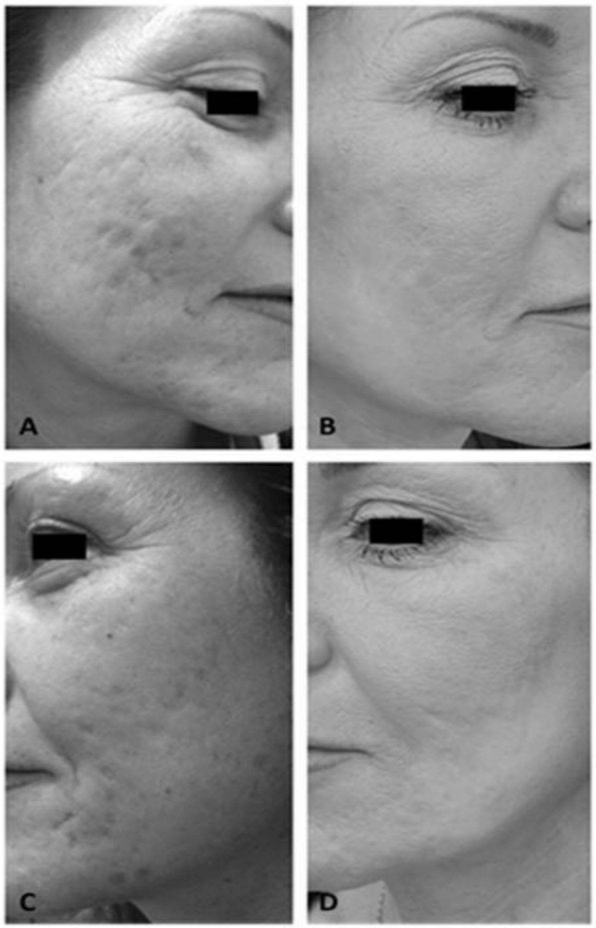
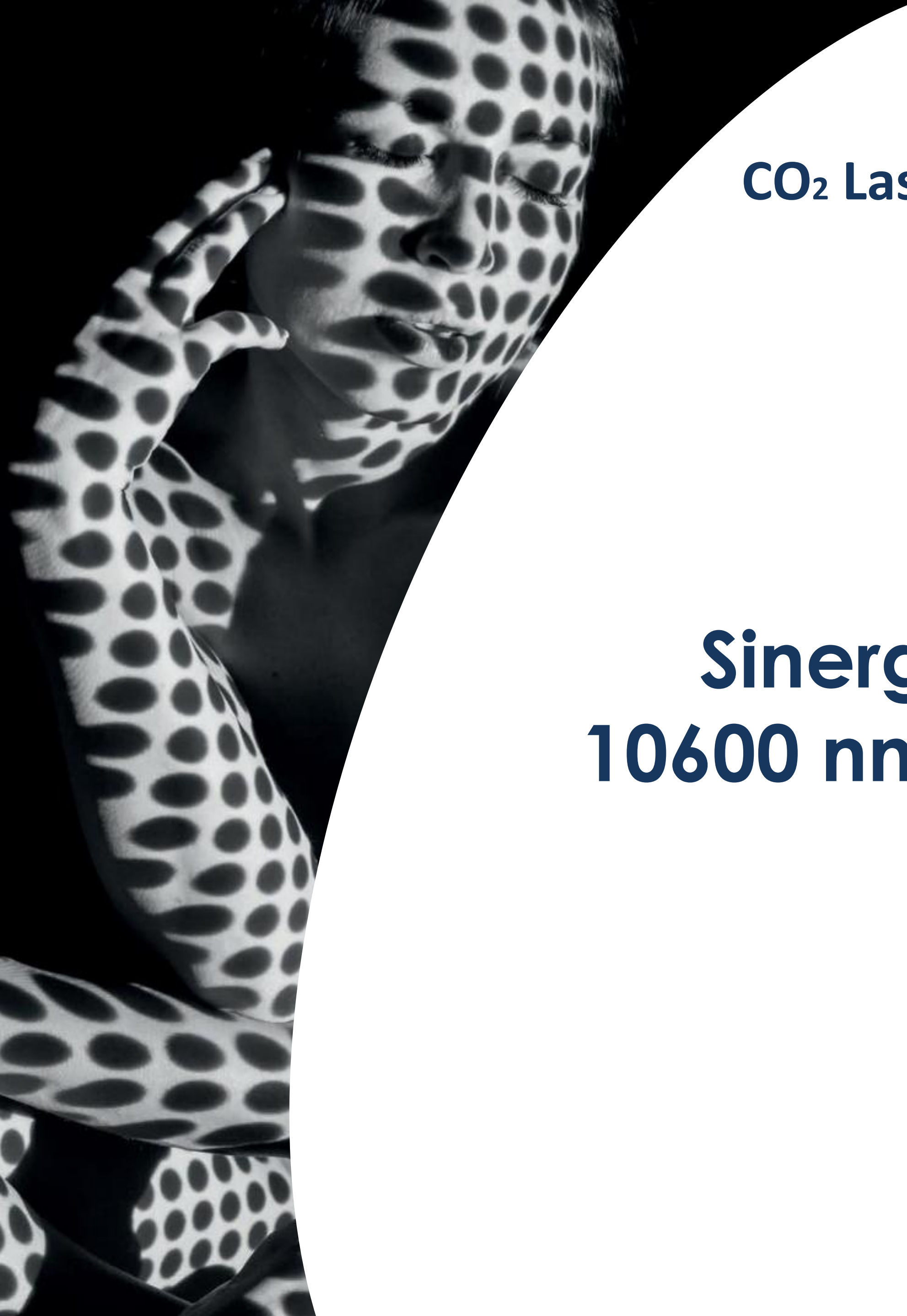


Figure 2. Right lateral view of a female patient's cheek before (**A**) and after 4 laser treatments (3 MFU after the last treatment session) (**B**). Left lateral view of a female patient's cheek before (**C**) and after 4 laser treatments (3 MFU after the last treatment session) (**D**).

Utilizing the 1540 + CO_2 sequence, one pass across the specific treated area was performed; thus, both wavelengths simultaneously targeted the skin. For this purpose, treatments were carried out using a fractioned scanning unit (µScan DOT).

The laser parameters for the CO_2 wavelength source were as follows: power, 10–15 watts; dwell time, 900–1000 µs; SP pulse; spacing, 500–700 µm; Stack 1–2; energy/DOT, 20.1–50.7 mJ (for the 1540 nm source, energy/DOT was 15–20 mJ).

Patients underwent 2–4 treatment sessions depending on the severity of the lesions, and the treatments were performed once every 45–90 days.



Bibliographic Atlas

CO_2 Laser in Dermatological Applications

Sinergy between 10600 nm and 1540 nm

Blepharochalasis

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ORIGINAL ARTICLE

WILEY

Laser-assisted blepharoplasty: An innovative safe and effective technique

Paolo Bonan[1] | Irene Fusco[2] | Nicola Bruscino[1] | Francesca Madeddu[2] | Michela Troiano[1] | Alice Verdelli[1] | Domenico Piccolo[3] | Giuseppe Rampino[1]

Background: Blepharoplasty is one of the most popular esthetic procedures with an acceptable risk profile and a relatively quick procedure.

Methods: The aim was to evaluate the efficacy and safety of a new CO2 and 1540-nm laser-assisted blepharoplasty technique applied to the upper and lower eyelids. A total of 38 patients were enrolled. Photographs were taken before the treatment and at 6-month follow-up. One "blind" observer assessed the performance of this technique by ranking the results in four categories of eyelid esthetic: 1 =no or poor results (0%–25%), 2 =slight improvement (25%–50%), 3 =moderate improvement (50%–75%) and 4 =marked improvement (75%–100%). All possible complications were monitored.

Results: Thirty-two patients (84 %) achieved marked improvement, four patients (11%) moderate improvement, two patients (5 %) slight improvement, while zero subjects (0%) poor or no improvement. No serious adverse effects were observed.

Conclusions: Our results from clinical evaluations suggest that the CO2 and 1540-nm laser assisted blepharoplasty is proved to be a sophisticate intervention efficacious in improving the treatment of patients with various degrees of eyelid and periocular aging and also in reducing downtime.

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ORIGINAL ARTICLE

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Laser-assisted blepharoplasty: An innovative safe and effective technique

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Upper eyelid blepharoplasty

FIGURE 2: Preoperative (upper panel) and postoperative (lower panel) images. Clinical improvement in upper eyelid blepharoplasty in female patient at 6-month follow-up**.**

… As a first step, we applied CO2 laser using freehand handpiece with slim handle (1.5″ or 2″ focal lengths) with HP Pulse, a frequency range of 50–80 Hz and a power range of 2–4 W to generate **superficial vertical incisions of the skin following the premarked lines.**

After concluding the incision, an edge of skin flap is pulled upward with surgical pliers and the **redundant skin flap was dissected from the underlying tissues by the focused CO2 slim handpiece.** Only the last corner of the skin flap is severed with surgical scissors. During this procedure, the laser beam of slim handpiece forms a 45-degree angle with the skin surface.

The next step is to remove prolapsed orbicularis oculi muscle, with the surgical scissors and to **irradiate the incision margins by defocusing laser beam** with the HP pulse. **These thermal effects allow for the convergence of margins**, facilitating the closure by the surgeon of the incision margins with six 6–0 nylon sutures.

Only in the cases presenting an important amount of eyelid fat accumulation, we partially resected also the muscle, orbicularis oculi, in the preseptal part and through a limited gap ofthe orbital septum, **we could arrive to the fat, deciding the amount to be removed through the CO2 laser cauterization**. **The CO2 laser employment allowed us also to guarantee a near absolute hemostasis, since the possible bleeding could be always stopped through the coagulative effect of the defocused beam of CO2 laser.**

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ORIGINAL ARTICLE

Laser-assisted blepharoplasty: An innovative safe and effective technique

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FIGURE 1: Preoperative (upper panel) and postoperative (lower panel) images. Clinical improvement in upper and lower eyelid blepharoplasty in female patient at 6 months follow-up.

Lower eyelid blepharoplasty (transconjunctival technique)

…After rotating outward, the lower eyelid, we always **executed the CO2 laser subciliary incision 4–5 mm below the eyelid margin**, following an imaginary transverse line from the lower part of lacrimal punctum to the lateral canthus.

Compressing the eye globe we could evaluate the protruding fat, removing it through the delicate dissecting effect of CO2 laser and without violating the orbital septum. In particular, using two cotton buds, the excess fat is pushed outward, and the subcutaneous vascular component is clamped**. The CO2 laser is used near the clamp in order to coagulate the vessels and thus remove the adipose tissue without excessive bleeding.**

We always concluded the lower eyelid transconjunctival blepharoplasty, employing the **synergic fractional effects of CO2 and 1540 lasers for reducing the lines and the wrinkles left on the lower part of the periorbital area**; this last procedure is relevant especially for the transconjunctival technique, which is not able to of remove excess skin.
The fractional CO2 and 1540-nm session entailed one pass only per area with numerous successive and consecutive pulses in the same point (DOT) without moving the scanner. The settings included: 12 W power, 500 µm DOT spacing, 800 µs dwell time, DP pulse, stacking 2 for CO2 laser and 5 W power and 3 ms dwell time for 1540-nm laser. We decided to use the CO2 +1540 sequence because, following this order, there is a greater shrinkage effect on the skin

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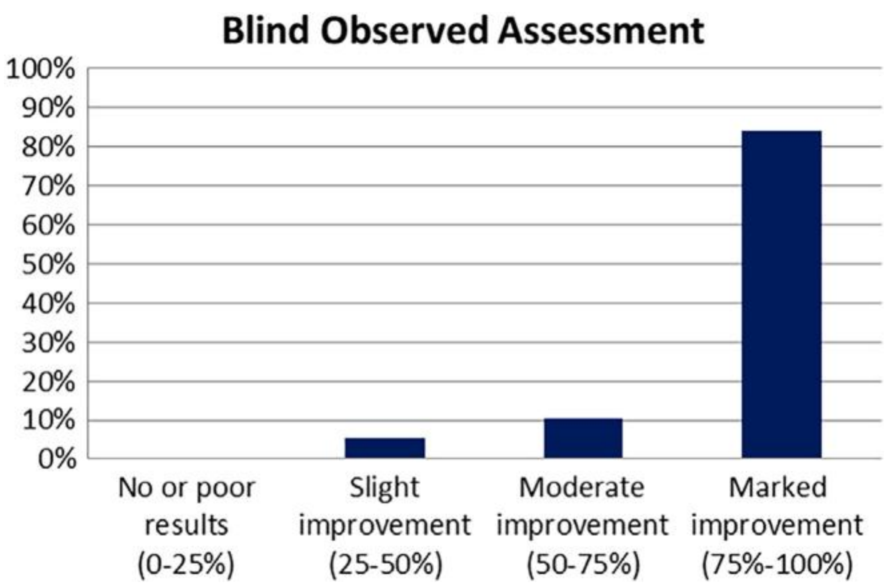

Figure 3: Blind observer's assessment of patients' improvements at 6-month follow-up

Figure 4: Histogram showing the degree of patient satisfaction after 6-month follow-up

THANK YOU FOR YOUR ATTENTION