

Fractional CO₂ Laser Skin Resurfacing for the Treatment of Sun-Damaged Skin and Actinic Keratoses

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It is important to realize that laser technology can be used to address both medical and cosmetic problems. Actinic keratoses are considered the earliest stage in the continuum of the development of squamous cell carcinomas and should be treated expeditiously. We report a case of a 72-year-old woman who showed excellent response to treatment with a fractional carbon dioxide (CO₂) laser for the treatment of actinic keratoses, actinic damage, and pigmentation that also eliminated mild wrinkles that extended over the entire face in the same procedure. Use of the fractional CO₂ laser should be considered to treat sun-damaged skin with the earliest signs of skin cancer, ie, actinic keratoses, as well as for laser skin resurfacing and skin rejuvenation.

A 72-year-old woman who enjoyed visiting Cape Cod, Massachusetts, and golfing in Florida throughout her life presented to the clinic. The patient's medical history was remarkable for hypertension and allergy to penicillin. The patient underwent a total left knee replacement in 2001 and back surgery in 2005. She had a past dermatological history of actinic keratoses, which was treated previously with cryosurgery in 2008 and in the spring of 2009. Seborrheic keratoses on the patient's hand and leg also were removed.

On physical examination, there were numerous, erythematous, scaly, variably-sized lesions over her cheeks, nose, and chin. Deep wrinkles were noted in the glabellar region, upper lip, and nasolabial folds; and marionette lines with shallow wrinkles were noted extending around the eyes, chin, and cheeks. Skin discoloration and scaling were noted on the lateral cheek areas extending to the condyle and neck as seen in Figures 1, 2, and 3.

After washing the face with creamy soap, a topical pilocarpine/lidocaine ointment was applied to the entire face for approximately one hour prior to the procedure. The topical pilocarpine/lidocaine ointment was removed and the patient's eyes were covered by nonreflective goggles. A fractional CO₂ laser (Mixto SX) was used with the following settings: forehead index 5, power 12 W; cheeks index 4, power 16 W; perioral area index 4, power 16 W; and periocular index 6, power 12 W. A double twist was used in the glabellar region with 40% coverage of the upper lip. An immediate reaction of mild erythema was seen (Figure 4). Tiny, tan, gridlike eschars were evident

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Figure 1. A 72-year-old woman presented with numerous, erythematous, scaly, variably-sized lesions over her cheeks, nose, and chin consistent with actinic keratoses and sun damage.



Figure 2. Actinic keratoses and discoloration.

upon close inspection as seen in Figure 5. These are not to be removed physically, but will dissipate on their own over the next few days following treatment.

Erythema and mild edema is expected during the week following treatment with fractional CO₂ laser and can be minimized by keeping the skin clean and moist. In this case, the patient used a nonsteroidal, anti-inflammatory, and collagen-rich ointment (Catix 10) repeatedly, with results noted at 6 days posttreatment as seen in

Figures 6, 7, and 8. After treatment, the patient reported minimal pain. After this time, sunscreen should be used and cover-up may be applied as the patient ventures out.

Three months after fractional CO₂ laser treatment, the patient was clear of sun damage and actinic keratoses as seen in Figures 9, 10, and 11. The patient's skin was smooth to the touch. Sunscreen must be used regularly with proper reapplications. Further collagen regeneration and improvement may be expected during



Figure 3. Discoloration and scaling were noted on the lateral cheek area extending to the condyle and the neck.



Figure 4. Mild erythema immediately following treatment with fractional CO₂ laser for the treatment of actinic keratoses and sun damage.

the months following treatment. At the time of publication this patient remains clear and without recurrences 7 months postprocedure.

COMMENT

The importance of treating actinic keratoses, the earliest stage in the continuum of the development of squamous cell carcinoma, field therapy, and the usefulness of lasers

as a modality for the treatment of sun damage and actinic keratoses has been documented.¹ Laser technology has been difficult to use in the past considering the patient downtime; the need for potent anesthesia; the risk for hyperpigmentation, hypopigmentation, and scarring; the cost; and the potential local side effects.^{2,3}

The 1540 nm fractional CO₂ laser with a microspot (300 μm) system and a specific rapid scanning algorithm



Figure 5. Immediately following treatment with fractional CO₂ laser, tiny, tan, gridlike eschars are evident.



Figure 6. Six days posttreatment, a nonsteroidal, anti-inflammatory, and collagen-rich ointment is used to keep the treated area moist.

(Computerized Pattern Generator) makes it possible to maintain the longest interval between 2 adjacent spots with minimal heat accumulation around treated areas, therefore, reducing pain. Fractional CO₂ laser skin resurfacing at depths from 20 to 500 μm can be achieved.⁴ Actinic keratoses and actinic damage are removed, wrinkles and fine lines are softened, and skin texture and color are improved. Fractional CO₂ lasers have been

used for skin rejuvenation and skin resurfacing with and without topical anesthetics. There is minimal discomfort associated with the procedure when used in conjunction with a topical anesthetic.⁴

Although midinfrared devices penetrate into deeper levels of the skin, the procedures are more painful and there is concern about postinflammatory changes. The fractional CO₂ laser uses a higher



Figure 7. The right side of the patient's face 6 days posttreatment.



Figure 8. The left side of the patient's face 6 days posttreatment.

depth of penetration and accomplishes treatment of sun-damaged skin and actinic keratoses with excellent results. In this case report it is notable that the power (W) was varied to regulate the depth of ablation for various areas of the face according to the damage observed, taking into consideration different sites and skin thicknesses (15 μm on the eyelid to millimeters on the forehead)(K. Martorelli, personal interview, October 12, 2009).⁴

Technical acuity is necessary to adjust laser treatments in order to achieve the best results. For instance, an overlapping scanned spot with a 45° angle of rotation creates a microspot of a density of 40%, and is helpful when treating excessively sun-damaged areas and senile lentigines.

Because the treatment is fractional, the remaining untreated skin serves as a reservoir for rapid and efficient healing. New collagen formation is stimulated throughout the area and continues for approximately 6 months.



Figure 9. Frontal view of the patient's face 3 months after fractional CO₂ laser treatment.



Figure 10. Right side of the patient's face 3 months after fractional CO₂ laser treatment.

Immediately after treatment, patients experience mild burning that lasts from 30 minutes to 3 hours. Treated skin exhibits the fine pinpoint pattern of the laser treatment that begins to dissipate in 24 to 48 hours. Peeling proceeds with washing from 72 to 96 hours and is completed in about 5 to 7 days. Healing continues for another 3 to 6 months making the skin smooth and clear. Proper sun avoidance, the use of a broad-spectrum sunscreen with a sun protection factor of 30 or more

and a UVA component, and reapplication every 2 to 3 hours is imperative.

CONCLUSION

The fractional CO₂ laser used to treat this patient exemplifies the utility of this minimally-invasive procedure. In this case report, a single treatment eliminated approximately 90% or more of the patient's sun-related facial skin damage by fractional CO₂ laser



Figure 11. Left side of the patient's face 3 months after fractional CO₂ laser treatment.

skin resurfacing as well as skin rejuvenation with minimal downtime and discomfort. Since a great deal in field therapy of actinic keratoses can be achieved and the results are excellent, the medical use of fractional CO₂ lasers should become a standard modality in the dermatologist's armamentarium of choices for the treatment of actinic keratoses and sun damage.

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