

Review Article

Fractionated CO₂ Laser Resurfacing: Our Experience With More Than 2000 Treatments

Christopher M. Hunzeker, MD; Elliot T. Weiss, MD; and Roy G. Geronemus, MD

Fractionated carbon dioxide (CO₂) laser resurfacing combines the concept of fractional photothermolysis with an ablative 10600-nm wavelength. This technology allows for the effective treatment of rhytides, photodamage, and scars, with shorter recovery periods and a significantly reduced side effect profile as compared to traditional CO₂ laser resurfacing. In this article, the authors review the concept of fractional photothermolysis, the expanding array of indications for use of fractionated CO₂ lasers, and their preferred treatment technique. (*Aesthetic Surg J* 2009;29:317–322.)

For nearly 15 years, the carbon dioxide (CO₂) laser has been the gold standard treatment for skin resurfacing. Despite its superiority in the treatment of rhytides,^{1–3} photodamage,^{4,5} and acne scars,^{6,7} the CO₂ laser has fallen out of favor in recent years because of the lengthy recovery period required after treatment and the high reported incidence of serious side effects. The two most notable and well documented side effects of CO₂ laser resurfacing are scarring and delayed onset hypopigmentation.

SIDE EFFECTS OF CARBON DIOXIDE LASER RESURFACING

Tissue ablation and thermal coagulation of the dermis are thought to drive the robust dermal remodeling that translates into clinical improvement following CO₂ laser resurfacing. However, excessive ablation and thermal damage is responsible for the scarring that can occur after CO₂ laser treatment. More aggressive treatments with higher energies and an increased number of passes can provide more dramatic clinical results; however, this comes at the expense of an increased risk for scarring. For these reasons, the skill and expertise of the practitioner is key in avoiding overly aggressive treatments. The development of high-energy pulsed CO₂ lasers and the flash scanner CO₂ laser system reduced the incidence of scarring compared to the original continuous wave CO₂ laser, but scarring continues to remain a concern with these lasers.

Hypopigmentation of CO₂ laser-treated skin is a late-appearing but permanent side effect reported to occur in up to 57% of patients.^{8,9} The observed hypopigmentation may be divided into cases of true hypopigmentation, defined as decreased melanogenesis, and pseudohypopigmentation, defined as relative lightening of treated skin compared to adjacent untreated bronzed and sun-damaged skin.^{2,9,10} Whether true or pseudo, hypopigmentation creates noticeable lines of contrasting colors along the border of treated and untreated skin. This undesirable effect draws attention to the treated area and is cosmetically disturbing to patients.

DEVELOPMENT OF ABLATIVE FRACTIONAL RESURFACING

The avoidance of scarring, hypopigmentation, and lengthy recovery periods is a major factor behind the development and rising popularity of newer nonablative lasers. These nonablative lasers generally target the dermis and attempt to stimulate dermal remodeling while avoiding epidermal injury and prolonged healing times. Although very safe, these devices are unable to generate significant dermal coagulation. As a result, their clinical results are modest at best compared to those of CO₂ laser resurfacing.

The concept of fractional photothermolysis (FP)¹¹ revolutionized laser surgery by enabling the delivery of dermal coagulative injury without confluent epidermal damage. Originally designed to emit a shorter nonablative wavelength, FP systems deliver microthermal zones (MTZ), which are columns of controlled thermal injury to the skin, in an evenly spaced pattern resembling pixels in a digital image. MTZ are surrounded by healthy, untreated skin, which allows for rapid reepithelialization

Dr. Hunzeker is a dermatologist in private practice in Pittsburgh, PA. Drs. Weiss and Geronemus are dermatologists in private practice in New York, NY.

via the migration of cells from immediately adjacent epidermis and follicular units. Repair of dermal injury is also accelerated because of the proximity of healthy fibroblasts, which are able to upregulate collagen production, migrate into the treated dermis, and facilitate collagen remodeling. Efforts to improve upon nonablative FP systems have led to the development of a new generation of fractional ablative CO₂ lasers.

Ablative fractional resurfacing (AFR) was created by combining the 10600-nm wavelength of the CO₂ laser with an FP system. AFR achieves controlled tissue vaporization and thermally-induced dermal coagulation extending to far greater depths than those of both traditional CO₂ lasers and newer nonablative devices. AFR thereby produces greater tissue contraction, collagen production, and dermal remodeling than is seen with nonablative FP devices. The net effect is the ability to obtain clinical efficacy approximating that of traditional CO₂ laser ablation while enjoying a much more favorable side effect profile.

The advantages of AFR over traditional CO₂ laser resurfacing are numerous. Most notably, with proper technique, there is a very low risk of scarring or hypopigmentation. We have used AFR in our office to perform more than 2000 procedures in the past four years, with an overwhelmingly positive response from patients. To date, we have not experienced a single case of scarring or hypopigmentation. While idiosyncratic responses can lead to complications, the few reported cases of AFR treatment-related scarring in the literature^{12,13} are likely attributable to improper treatment technique or overly aggressive energy or density settings (see discussion on treatment technique below).

Beyond avoiding the serious long-term complications seen with CO₂ laser resurfacing, AFR allows for much quicker recovery and fewer short-term side effects. Following full-face resurfacing with AFR, complete reepithelialization is generally seen in three to six days. This is in stark contrast to the two to three weeks of recovery following full-face resurfacing with traditional CO₂ laser systems. Rapid reepithelialization after AFR treatment results in very few infections, which are further reduced with the recommended use of prophylactic antiviral and antibiotic medications. Faster reepithelialization also results in patients requiring fewer days of occlusive ointment application. This greatly reduces the rate of acneiform eruptions, which are seen in up to 83 % of patients treated with traditional CO₂ lasers.¹⁰ Erythema, an expected side effect after treatment, also resolves much more quickly after AFR compared to nonfractionated CO₂ laser treatments.

TYPES OF ABLATIVE FRACTIONAL RESURFACING DEVICES

The impressive clinical results and favorable side effect profile of AFR has generated a new market for ablative fractional devices. There are currently a number of laser devices available that incorporate AFR technology, but a detailed evaluation of each of these devices is beyond the

scope of this article. It should be noted, however, that the major differences between devices pertain to the depth of ablation and coagulation and to variations in treatment handpieces. These handpieces determine the manner in which the treatments are performed. The authors' experience is primarily with the Fraxel re:pair laser (Solta Medical, Hayward, CA), which has a continuous motion (rolling) optical tracking system. The handpiece evenly delivers MTZ with a 135- μ m diameter by adjusting its scanning system according to the operator's hand speed, allowing for consistent and efficient treatments. Other AFR devices equipped with "stamping" handpieces require more time to treat and considerable effort to perform an even treatment without undesired overlap. This is particularly evident on concavities and convexities of the face that are difficult to treat, such as the nose. The depth of ablation and coagulation of the laser is also important, as it directly correlates with treatment efficacy.^{8,14} The Fraxel re:pair laser has been shown histologically to deliver MTZ that extend to a depth of 1.6 mm into the dermis (at 70 mJ). Manufacturers of other fractionated CO₂ lasers have made claims that their devices deliver ablation and dermal coagulation penetrating to depths of 50 μ m to 2000 μ m.

TREATMENT INDICATIONS AND METHODS

Similar to traditional CO₂ laser resurfacing, the most common indications for AFR treatment are facial rhytides, sun-damaged skin, and acne scarring. Considerable improvement and patient satisfaction is usually attained with one or two treatments. Rarely, with deep acne scars, additional treatments are performed with resultant incremental cosmetic improvements. The beauty of AFR is that one can safely treat the entire face, the neck and chest, individual cosmetic units, or even individual scars without a concern for pigmentary alteration. As with any laser treatment, all AFR treatments should begin first with a consultation in which expectations are set. The patient should be fully informed about necessary pretreatment prophylaxis, anesthesia, post-treatment skin care, and follow-up visits.

In our practice, full-face AFR treatments were performed in an outpatient office setting. Some physicians prefer to perform the procedure with intravenous sedation administered by an anesthesiologist in the outpatient setting or under general anesthesia administered in an operating room. Our patients began a seven-day course of prophylactic antibiotic and antiviral medications one day before the procedure. They arrived one hour before their scheduled treatment, at which time they received preoperative medications (an intramuscular dose of ketorolac [60 mg], an oral dose of diazepam [5–10 mg], and an oral dose of acetaminophen/oxycodone [5/325 mg]). A topical anesthetic (7% lidocaine/7% tetracaine) was applied to the treatment areas and remained on the skin for 60 minutes. Fifteen minutes before the procedure, supraorbital, infraorbital, and mental nerve blocks were administered using a

Download English Version:

<https://daneshyari.com/en/article/4277529>

Download Persian Version:

<https://daneshyari.com/article/4277529>

[Daneshyari.com](https://daneshyari.com)