INNOVATION IN SKIN REJUVENATION TECHNOLOGY

Targeted Energy Delivery with High Intensity Focused Radiofrequency

FACULTY
MATTEO TRETTI CLEMENTONI, MD
JOEL L. COHEN, MD
JEREMY B. GREEN, MD
GIRISH S. MUNAVALLI, MD, MHS, FAAD, FACMS
E. VICTOR ROSS, MD

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At a symposium held during the annual meeting of the American Society for Laser Medicine and Surgery, an international faculty of leading dermatologic surgeons shared their perspectives on skin rejuvenation with INFINI™ (Lutronic, Inc; Fremont, CA). They described the principles and advantages of using high intensity focused radiofrequency and reviewed clinical outcomes achieved using INFINI in its approved indication to treat facial lines and wrinkles and for off-label treatment of acne scars and laxity of the lower face and neck. Highlights of the session are summarized in this supplement.

Exploring the Best Way to Deliver Radiofrequency Energy

E. VICTOR ROSS, MD

The success of energy-based technologies for skin rejuvenation depends on their ability to address the histological and ultrastructural changes underlying the clinical manifestations. Through its ability to cause collagen coagulation that induces dermal remodeling with new collagen and elastin formation, ablative carbon dioxide (CO2) laser resurfacing remains the most effective modality for improving the appearance of facial lines, wrinkles, skin laxity, folds, and acne scarring. However, significant pain during the procedure, prolonged post-treatment downtime, and the risk of complications are limitations of ablative CO2 laser resurfacing. In addition, this modality must be used conservatively for tightening of the neck where the paucity of pilosebaceous units compromise healing of deeper wounds.

Fractional laser resurfacing emerged as one technique to overcome the drawbacks of ablative laser resurfacing. By leaving areas of normal tissue surrounding columns of damage, the fractionated procedure is associated with faster recovery and a better safety profile than conventional ablative resurfacing. However, nonablative fractional techniques are unable to match the efficacy of ablative CO2 laser resurfacing for improving skin laxity, and ablative fractional laser procedures can still be associated with a longer than desirable downtime.

Radiofrequency platforms were introduced more than a decade ago as another energy-based approach for tightening skin and reducing the appearance of wrinkles. In contrast to laser treatments, the effect of the radiofrequency procedure is mediated via an electrothermal reaction in which heat is generated when the radiofrequency electric current encounters tissue resistance.

Available radiofrequency platforms vary in terms of the design of the electrodes used to deliver the electric current, which has implications for their efficacy and
An alternative configuration, which is found on the INFINI system, insulates the needles along the entire shaft except at the tip. This design bypasses the epidermis and results in the delivery of high intensity focused radiofrequency energy specifically to the dermis. The INFINI system also gives the operator the ability to adjust needle insertion depth, energy power level, and exposure time. As demonstrated in a laboratory study using mini pigs as an in vivo model of human skin, these features afford control over the exact location and size of the electrothermal damage zone created within the dermis (Figure 1).1

Advantages of INFINI High Intensity Focused Radiofrequency

With its unique attributes, high intensity focused radiofrequency with INFINI adds value for practitioners wanting to meet growing patient demand for effective rejuvenation procedures that require little downtime. Tolerability and safety are excellent. Some anesthesia is needed during the procedure to maintain patient comfort, but there is no pain after the treatment is completed. Otherwise, postprocedural sequelae are typically limited to mild erythema and edema that generally resolve within 1 or 2 days. Bruising is sometimes observed and tends to occur more in older patients and with greater insertion depths. The fact that the treatment bypasses the epidermis eliminates the need for cooling strategies during the procedure.
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How INFINI Works

JOEL L. COHEN, MD

INFINI high intensity focused radiofrequency rejuvenates signs of aging skin and acne scarring by creating fractional radiofrequency coagulation of dermal collagen. The treatment results in immediate collagen contraction and triggers a natural healing response that over time leads to replacement of damaged connective tissue with new, healthier skin. With the ability to control treatment depth and by using a multipass technique, high intensity focused radiofrequency with INFINI can treat multiple layers of the skin to generate a 3-dimensional volumization (Figure 3).

The treatment is performed using a sterile, single-use disposable tip that fits onto a lightweight, ergonomically designed handpiece and contains a spring-loaded, bipolar array of positive and negative electrodes (Figure 4).

The microneedles are 200 μ in diameter and taper at the end to a very sharp, 20-μ diameter tip (~34 gauge). Made of surgical stainless steel, the microneedles are covered with gold to increase conductivity, and they have an outercoating that provides insulation along the entire length of the needle except for a discrete uncoated active area at the distal end.

Once the radiofrequency power is switched on, electric current moves between the active tips of the positive and negative electrodes. Tissue resistance to the current results in generation of heat, ultimately resulting

Figure 2. Before and 1 month after a single INFINI treatment. (Images courtesy of E. Victor Ross, MD)
in zones of coagulative damage that are limited to the tissue around the active areas of the needle tips.

INFINI treatment depth and intensity are fully adjustable. Using the touchscreen display on the graphic user interface (GUI) or by turning a control dial on the handpiece, the treatment depth can be set over the range of 0.5 to 3.5 mm in 0.5-mm increments. Radiofrequency power and exposure time are adjusted using the GUI touchscreen display. The radiofrequency power is chosen from among 20 levels representing increments of 2.5 W across the range of 2.5 W (level 1) to 50 W (level 20). The exposure time can be varied from 10 ms to 1000 ms.

When performing a multipass treatment at different levels in the dermis, it is recommended that the needle depth be set at the maximum desired penetration for the first pass and then decreased successively for subsequent passes. As the treatment level becomes increasingly superficial, the power and/or exposure time should also be adjusted to decrease the intensity in order to avoid epidermal damage from conducted heat.

At the shallowest depth of 0.5 mm, the active needle tip is still beneath the dermal-epidermal junction, which explains why there is very little risk for pigmentation changes with an INFINI procedure. The deepest depth, 3.5 mm, may be chosen when treating certain acne scars, although it is generally not used in procedures for rejuvenating aging skin. The depth for the latter procedures is usually ≤2.5 mm when treating on the upper lip and cheek and ≤1.5 mm on the forehead, around the eyes, and on the neck.

A full-face treatment is completed in about 30 minutes, and treatment for the neck adds another 15 minutes. A procedure that treats the whole face and neck with 3 passes delivers a total of about 1000 pulses, creates about 50,000 microcoagulation zones at selectable depths, and replaces 25% to 30% of damaged collagen per level. The entire procedure is completed using only 1 tip.

Each Treatment Session Places 50,000+ Microcoagulation Zones

- Multilayer approach
- Multiple passes
- Selectable depths

Figure 3. High intensity focused ultrasound performed in a multilayer approach with 3 passes at varying depths results in 3-dimensional fractional tightening with stimulating volumization. (Image courtesy of Lutronic)

Figure 4. The INFINI tip measures 10 mm x 10 mm and contains 49 insulated microneedles in a 7 x 7 array. (Image courtesy of Lutronic)
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INFINI, a number of devices that failed to live up to their promise and fallen into disuse. Against this background, we have learned to carefully assess new technology in order to determine whether it does what it claims to do. And, with an already replete arsenal of skin rejuvenation tools, we must also consider whether a new system provides any unique advantages compared with existing devices or if it fills any unmet needs.

It is with this critical eye that my associates and I agreed to trial high intensity focused radiofrequency with the INFINI. While skeptical that we would be impressed enough to consider adding it to our practice, we were quickly convinced otherwise after just a few treatments. In the 6 months that have passed since our initial experience, the INFINI has become a reliable workhorse in our practice for skin rejuvenation procedures and treatment of acne scarring. As our practice is located in Miami, FL, the ability to safely treat patients with tanned and darker skin types is a real asset of the INFINI.

Acne Scarring

Acne scarring is a common problem that can have a negative impact on quality of life. There are many different surgical modalities that can be used to treat acne scars, but the specific role of these options may vary depending on the scar type. High intensity focused radiofrequency with the INFINI, however, represents a minimally invasive procedure that can be used successfully to treat a range of acne scars.

A published study from investigators in India further demonstrates the efficacy of high intensity focused radiofrequency with the INFINI.
Published as a promotional supplement to Dermatology Times

my hands, good results have been achieved using the INFINI to treat all types of atrophic acne scars, including ice pick, rolling, and boxcar scars.

High intensity focused radiofrequency with the INFINI is showing promise for flattening papular scars, and it is suitable for use in combination protocols. In particular, treating patients in the same visit with the INFINI and the SPECTRA™ Q-switched Nd:YAG laser using the Gold handpiece (Lutronic, Goyang, South Korea) has been helpful for simultaneously addressing the atrophic defect and the postinflammatory erythema that may also be present in some acne scars.

Neck and Lower Face Laxity

MATTEO TRETTI CLEMENTONI, MD

The ability to heat at variable depths with the INFINI allows for treatment of different acne scar morphologies, and in my hands, good results have been achieved using the INFINI to treat all types of atrophic acne scars, including ice pick, rolling, and boxcar scars.

Figure 5. Before and 6 weeks after a single INFINI treatment. (Images courtesy of Joely Kaufman, MD and Jeremy B. Green, MD)

radiofrequency for treatment of acne scars.2 This retrospective analysis reviewed pre- and post-treatment photographs of 31 patients with skin types 3 to 5 who had moderate-to-severe atrophic acne scars (grade 3 or 4 on Goodman and Baron’s qualitative acne scar grading system). The treatment parameters were individualized based on scar characteristics, but all patients had 4 treatment sessions with an interval of 6 weeks between sessions.

The investigators reported substantial improvement in the appearance of all types of acne scars characterized by softening of the contours and reduction in depth. A 2-grade improvement in scar severity score was achieved by 86% of patients with grade 4 scars and 76% of those with a grade 3 scar, and all of the remaining patients achieved a 1-grade improvement.

Mild erythema lasted up to 2 days post treatment. Other transient adverse events included edema persisting for more than 3 days in 2 patients, postinflammatory hyperpigmentation in 5 patients, and track marks from the probe in 2 patients.

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Neck and Lower Face Laxity

MATTEO TRETTI CLEMENTONI, MD

The opportunity to safely and effectively correct laxity of the lower face and neck skin with high intensity focused radiofrequency treatment is an important advance considering that previously, reliably good results could be achieved only with incisional surgical lifting procedures.

Over time, I have refined my protocol for treating skin laxity in these areas using the INFINI, and my technique

Figure 5. Before and 6 weeks after a single INFINI treatment. (Images courtesy of Joely Kaufman, MD and Jeremy B. Green, MD)
now involves 3 passes. Because neck skin on average has a thickness of around 2 mm, the first pass is performed at a depth of 1.75 or 2 mm, using a mid-range power setting, an exposure time of around 300 ms, and moving the handpiece laterally in an oblique direction from the midline. The depth, power, and time settings are decreased for each successive pass. The second pass is done in a vertical direction, and the oblique approach is used again for the final pass. Next, the triangle under the chin and then the lower one-third of the face are each treated with 3 passes in which the treatment parameters are progressively reduced.

In order to quantify the results of the procedure, we used computerized digital image analysis to calculate changes in the gnathion and cervicomental angles in a series of 30 patients. The study group included men and women ranging in age from 36 to 74 years (mean age 51.5 years). Most patients underwent 3 treatment sessions at intervals of 4 weeks.

The results showed statistically significant improvements in both anatomic measurements. At baseline, the mean cervicomental angle was 137°, and it was reduced by 27.2° (mean change −19.8%, P<.01). The mean gnathion angle was 107° at baseline and decreased 16° post treatment (mean change −15%, P<.01). As further evidence of the procedure’s efficacy, 2 blinded, independent physicians correctly differentiated between the pre- and post-treatment images for all patients. Figure 6 shows before and after images from a patient included in the study. The remarkable improvement is representative of the results achieved.

In conclusion, INFINI high intensity focused radiofrequency treatment brings a new level of precision to skin rejuvenation procedures through the ability to control the intensity of energy delivered and its depth. By using insulated needles and sparing the epidermis, it has distinct advantages over other devices for treating laxity of the neck and lower face, and it is also unique in its efficacy and safety profile as a treatment for facial wrinkles and acne scars in all skin types. While we can expect to see a growing list of applications for the INFINI in the future, there are enough reasons now to encourage clinicians to adopt this novel system.

REFERENCES