Radiofrequency facial rejuvenation: Evidence-based effect

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Background: Multiple therapies involving ablative and nonablative techniques have been developed for rejuvenation of photodamaged skin. Monopolar radiofrequency (RF) is emerging as a gentler, nonablative skin-tightening device that delivers uniform heat to the dermis at a controlled depth.

Objective: We evaluated the clinical effects and objectively quantified the histologic changes of the nonablative RF device in the treatment of photoaging.

Methods: Six individuals of Fitzpatrick skin type III to IV and Glogau class I to II wrinkles were subjected to 3 months of treatment (6 sessions at 2-week intervals). Standard photographs and skin biopsy specimens were obtained at baseline, and at 3 and 6 months after the start of treatment. We performed quantitative evaluation of total elastin, collagen types I and III, and newly synthesized collagen using computerized histometric and immunohistochemical techniques. Blinded photographs were independently scored for wrinkle improvement.

Results: RF produced noticeable clinical results, with high satisfaction and corresponding facial skin improvement. Compared with the baseline, there was a statistically significant increase in the mean of collagen types I and III, and newly synthesized collagen, while the mean of total elastin was significantly decreased, at the end of treatment and 3 months posttreatment.

Limitations: A limitation of this study is the small number of patients, yet the results show a significant improvement.

Conclusions: Although the results may not be as impressive as those obtained by ablative treatments, RF is a promising treatment option for photoaging with fewer side effects and downtime. (J Am Acad Dermatol 2011;64:524-35.)

Key words: collagen; elastin; nonablative; radiofrequency; skin aging.

There are two clinically and biologically distinct aging processes affecting the skin. The first is intrinsic aging, "the biologic clock," which affects the skin by slow, irreversible tissue degeneration.[1] The second is extrinsic aging, "photoaging," which was first described in 1986 as the effects of chronic exposure to the elements, primarily ultraviolet radiation on skin.[2-4] The histologic and ultrastructural hallmark of photodamaged skin is the accumulation of elastotic material in the papillary and mid dermis, a process known as solar elastosis.[5] Collagen, which comprises more than 80% of the total dry weight of the dermis, becomes disorganized with enhanced breakdown and reduced network formation.[6] These alterations contribute to the skin sagging and wrinkling.[7]

For more than half of a decade, many different laser and other light-based systems have been developed

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and evaluated for their capability to reverse photodamage and age-associated rhytides, a process referred to as photorejuvenation.[7,8] Although ablative lasers remain the gold standard for photodamaged skin rejuvenation, their use is associated with significant side effects, and a prolonged and an unpleasant posttreatment downtime.[9] Thus, in recent years, interest in ablative treatments has waned and nonablative skin rejuvenation has become an appealing alternative treatment.[10] Nonablative laser modalities are designed to produce favorable alterations in the dermis with no epidermal damage. However, laser light can be diffracted, absorbed, or scattered, and only small portions of the emitted energy reach the target of concern. Consequently, the effects are proportionally reduced.[11] The monopolar radiofrequency (RF) device is different from cosmetic lasers, as it produces an electric current rather than light. The energy produced is not liable to be diminished by tissue diffraction or absorption by epidermal melanin. As such, RF-based systems are appropriate for any skin type.[12] Monopolar RF therapy delivers uniform heat at controlled depth to dermal layers, causing direct collagen contraction and immediate skin tightening.[8,13] Subsequent remodeling and reorientation of collagen bundles and the formation of new collagen is achieved over months after treatment.[14] The purpose of the current study was to evaluate the effects of, and objectively quantify the histologic facial skin responses to, the monopolar RF device as a nonablative treatment of photoaging, and to assess whether multiple treatments would improve clinical outcome.

CAPSULE SUMMARY

- Monopolar radiofrequency is a valuable procedure that can be used to effectively tighten and rejuvenate photoaged skin with little downtime.
- Tightening appears to continue for 3 months after the end of radiofrequency treatment.
- Radiofrequency showed long-term effects by enhancing collagen synthesis and content.

METHODS

Study population

This study was conducted on a cohort of 6 female volunteers who desired an improvement in the appearance of facial skin laxity and wrinkles. The individuals, ranging in age from 47 to 62 years with an average of 51.1 ± 5.5 years, were recruited from the dermatology outpatient clinic of Al-Minya University Hospital, Al-Minya, Egypt. Treatment and study details were fully explained to subjects, and all signed an informed consent form. The volunteers were Fitzpatrick skin type III to IV, with class I to II wrinkles based on the Glogau scale.[15] Inclusion criteria included bilateral facial changes caused by sun damage. Exclusion criteria were pregnancy or nursing, photosensitivity to sunlight, any sign of infection or inflammatory skin disease, history of hypertrophic scars or keloids, use of oral isotretinoin in the past 12 months, and previous skin rejuvenation procedures in the facial area.

Device and techniques

We used a monopolar RF skin-tightening device (Biorad, Shenzhen GSD Tech Co, Guangdong, China) consisting of RF generator, computerized automatic resistance test technology, a continuous cooling system, and a 3-cm^2 tip. The RF generator produces a 6-MHz alternating current that creates an electric field through the skin, and allows for the heating of tissues through their resistance to the flow of electrical current. The physical properties, including frequency generator, frequency of electrical field polarity, and energy output, between the ThermaCool instrument (Solta Medical Inc, Hayward, CA) and our RF instrument are identical. Both instruments use capacitive coupling rather than conductive coupling to deliver the therapeutic energy. Conductive coupling is based on energy concentrated at the tip of an electrode, resulting in accumulation of produced heat at the skin surface in contact with the electrode, which can result in epidermal injury. Capacitive coupling creates a zone of increased temperature through dispersing energy across the skin surface.[10,12]

Briefly, a topical anesthetic cream (lidocaine 5%) was applied to the treatment area as a thick coating and left for 90 minutes under occlusion, then the cream was gently removed, and the patient was positioned for treatment. A conductive coupling fluid was applied to the treatment site to ensure uniform energy conduction, and enhance the thermal and electrical contact between the treatment tip and the skin. Two initial passes of 150 J each were performed over the entire face to allow uniform contraction of the collagen. We made 3 or more additional passes of 200 J each on the periorbital, nasolabial, and forehead areas. For each session, the total number of passes per treatment area consisted of the two initial passes over the entire face, followed by 3 to 6 passes targeted to treatment regions (total of 5-8 passes/treatment region). These data are described in Table I. Any overlap of pulses was avoided to allow appropriate cooling of the skin for at least 3