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BALANCING METHYLATION
AGEING AND DISEASE PREVENTION

TREATING STRETCH MARKS
A LITERATURE REVIEW

FACIAL HYPOPIGMENTATION
IN SKIN OF COLOUR

COMBINING RADIOFREQUENCY SYSTEMS
to treat the neck

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COMBINING RADIOfREQUENCY SYSTEMS TO TREAT THE NECK

Jason D. Bloom, MD, and Garrett D. Locketz, MD, discuss combining injectable and microneedle radiofrequency treatments to improve skin elasticity, ablate fat, and reduce wrinkles in the neck and lower jawline.

ABSTRACT
Microneedle radiofrequency (RF) and injectable RF technologies have recently been introduced to tighten skin by manipulating the skin’s underlying anatomy and physiology. These RF devices produce electrothermal injury to the dermis and subcutaneous tissues, inducing collagen denaturation and remodeling, resulting in skin tightening and rejuvenation. While both technologies have their individual merits, utilizing both systems as combinational therapy produces an unparalleled, multilevel 3-D criss-cross pattern of thermal injury to the dermis, subcutaneous fat, and the fibro-septal tissue network. In select patients, the resultant complex meshwork of RF thermal injury induces skin tightening, wrinkle reduction, and fat ablation beyond the capabilities of either modality alone. Combinational microneedle and injectable RF treatments can be executed with minimal additional capital cost and in a single patient visit, reducing downtime, obviating the need for additional anesthetic, and optimizing patient satisfaction.

THE REJUVENATION OF AGEING SKIN IS A FUNDAMENTAL treatment of the cosmetic clinician. With respect to aesthetics of the lower face and neck, the top concerns for patients are sagging skin, wrinkles, and jowling. For years, the methodology of choice for treating skin laxity in the non-invasive setting has been transcutaneous thermogenesis, whereby energy is used to create heat damage to the dermal and subcutaneous skin layers. This thermal injury ultimately results in collagen denaturation and contraction, activation of wound healing pathways, collagen remodelling, increase in collagen fibril size, and ultimately neocollagenesis—whereby new collagen fills in surface imperfections resulting in more youthful appearing skin.

Since the early 2000s, radiofrequency (RF) devices have remained a staple delivery system of transcutaneous thermogenesis for the treatment of skin laxity and facial rejuvenation. The aim of these RF devices is to induce electrothermal injury into the dermis and subcutaneous tissues at precise therapeutic heat levels that effectively promote collagen remodelling. Early RF devices emitted energy at the skin surface using electrode arrays which required energy to pass through the epidermis to heat the underlying dermis. This resulted in the potential for significant thermal injury to the skin surface in order to achieve optimal dermal temperatures for collagen remodelling, and thus aggressive skin cooling and short duration treatments were required. Surface temperature thresholds also limited the depth to which electrothermal energy could penetrate into the dermis, as increasing the RF power (and thereby depth) would necessarily increase the heat delivered to the skin surface.

To circumvent these issues, RF technologies recently began integrating microneedles or injectable probes that penetrate beyond the epidermis and induce thermal energy.
beneath the skin surface. In microneedle (or transcutaneous) RF technology, a 200–500 micron wide array of 20 micron diameter needles are injected into the dermis, approximately 0.5 to 3.5 mm beneath the skin surface, where heat energy is produced for periods between 10 to 1000 ms. The pattern of dermal injury created by microneedle RF arrays are minimal at the epidermis, and the energy pattern increases in size as it descends to deeper layers of the dermis. This results in a lower potential for skin surface injury while allowing for higher temperatures to be delivered to dermal collagen. Additionally, RF technology does not depend on interaction with chromophores to create heat, and therefore delivers a more even and widespread energy distribution that is safely used on all skin types without risk for hyperpigmentation.4,5

Microneedle radiofrequency systems
The two main varieties of microneedle RF systems are those with insulated needles and those without needle insulation. In non-insulated microneedle systems, the entire needle serves as the energy delivery system, and thermogenesis occurs along the entire needle length. Non-insulated needles deliver lower energy density with deeper needle insertion, as energy spreads along the entire needle length. The use of non-insulated microneedles also results in a treatment area free of bleeding points, as small venules in the epidermis are coagulated by the shaft of the microneedle. Conversely, only the tip of the microneedle delivers energy in insulated systems, resulting in smaller and more precise areas of energy delivery while keeping the overlying epidermis free from damage, but requires passes at multiple depths in order to deliver energy to the entire dermis. Some manufacturers use a fixed depth microneedle array, while others have energy penetration depths that can be adjusted (usually between 0.5 mm to 3.5 mm), allowing for more precise control and customization of treatment according to each specific indication. In some systems, the RF microneedle penetration depth can be adjusted in real time, allowing for the ability to deliver energy at multiple depths per needle pass.

Histologic analysis after these treatments show induction of coagulated columns in the dermis forming a cocoon-shaped zone of sublative thermal injury and affecting adnexal structures by coagulating the follicular epithelium and perifollicular structures. Four days after treatment, re-epithelialization is noted as well as neovascularization and granulation tissue formation6. In general, RF microneedle treatments are typically short (30–45 minutes for neck/pan-facial treatments) with 2 to 3 sessions necessary for optimal clinical results. Patient downtime is usually no more than 24 to 48 hours, and maximum effect peaks around 4 to 6 months after treatment. In a multicenter study of 499 patients using the INFINI system (Lutronic, Burlington, MA, USA) for treatment of facial skin wrinkles, results from all centres were overall very good to excellent, ranging from mild improvement to excellent in even severe wrinkles. Mild oedema was reported for 12–48 hours and erythema from 3–5 days, with no persistent erythema experienced by any patient in the study.

Benefits and limitations
In general, microneedle RF technology is an effective tool for wrinkle treatment, delivering precise heating of the reticular dermis. Nevertheless, treatment of conditions resulting from skin and soft tissue ptosis and laxity, subcutaneous fat deposits, jowling along the mandibular border, and prominence of platysmal banding requires a level of heating to the deeper layers of skin and soft tissue that cannot be achieved by RF microneedle technologies alone3,11. The dermis and underlying hypodermis create a complex collagen network involving the...
Percutaneous radiofrequency systems

The latest generation of minimally invasive RF technologies for use in cosmetic surgery is percutaneous (or injectable) temperature-controlled RF. Percutaneous RF devices operate under the same general principal as microneedle RF devices, with the exception that only one larger probe (1.2 mm in diameter and 10-15 cm in length) is used in percutaneous RF vs. an array of many smaller needles in microneedle RF. The percutaneous RF probe is inserted into the skin and is moved by the operator parallel to the skin’s surface, directing and fanning the energy within the targeted treatment areas (Figure 2 A-B). This allows the operator precise control over where the energy is delivered and provides energy to the deeper tissue layers than possible with microneedle RF, such as the papillary/reticular dermis and the subcutaneous fat and fibrous septae. Interestingly, energy delivery at these depths not only contributes to tightening and wrinkle reduction but also ablates subcutaneous fat and increases skin elasticity by remodelling its anchoring mechanism to the deeper fascia and muscle.

Currently, the only two percutaneous RF devices that are FDA cleared and on the market are ThermiTight (ThermiAesthetics, Southlake, TX, USA) and FaceTite (InMode, Lake Forest, CA, USA). The FaceTite system utilizes a solid, insulated, 10 cm long and 1.3 mm diameter bipolar RF applicator probe, while the ThermiTight device incorporates an either 10 or 15 cm long and 1.3 mm diameter monopolar RF probe. In both systems, the probe is passed directly under the skin through a small epidermal incision or needle opening into the hypodermal-subcutaneous fat space. RF energy is emitted from the non-insulated tip of the internal electrode, which causes coagulative necrosis of the subcutaneous fat, including the lower reticular dermis and the fibrous septae (Figure 3 A-B). A temperature sensor is integrated within the handpiece or electrode, which monitors subdermal temperatures during the treatment. These deeper temperatures are adjustable by the operator, and range between 50°C-70°C depending on the treatment area and desired effect. Additionally, an infrared camera system is included in the ThermiTight device package which monitors epidermal temperatures during treatment, and built-in safety mechanisms ensure the treatment electrode does not induce surface temperatures exceeding 47°C—although even lower temperature thresholds can be set by the operator. In this way, both the ThermiTight and FaceTite systems allow for simultaneous temperature regulation of dermal and subdermal tissue, permitting the system to reach the maximal therapeutic thresholds necessary for collagen remodelling, while protecting the epidermis from thermal injury. In general, the majority of the percutaneous RF procedures are conducted under tumescent anaesthesia, while some patients/practitioners prefer to perform selected nerve blocks using injectable anaesthetic. In a study of 42 patients presenting with neck and face skin laxity, significant tightening of the cheek, jaw line, and neck was achieved in all 42 patients after treatment with the FaceTite.
Figure 4 (A) before (B) after views of a woman in her late 50s who was looking to non-surgically improve her jawline and obtain neck tightening, and underwent treatments with percutaneous RF followed by RF microneedling.

Figure 5 (A) Before (B) after of a woman in her late 70s who was interested in non-surgical lipolysis and improvement of her submental area and neck tissue tightening. She underwent treatments percutaneous RF to deeply melt the adipose tissue and contour the neck followed by RF microneedling for skin tightening.

Combinational radiofrequency

When considering surgery for the treatment of facial and neck skin laxity and wrinkles, patients most often consider physician training/experience, duration of results, cost of procedures, gradual improvement over sudden appearance changes, and overall degree of invasiveness. That said, many patients today ultimately delay surgery for 1-2 years while looking for less costly and less invasive alternatives. With this changing aesthetic landscape, both microneedle and percutaneous RF technologies have the potential to revolutionize the practice of the aesthetic clinician with respect to face and neck rejuvenation. Each of these procedures has its own merits, indications, and considerations. Nevertheless, with experience, the astute practitioner can take advantage of each technology’s strengths, and combine their uses in the same tissue area for a synergistic result that is more effective with less downtime than using either alone. In selected patients, applying the percutaneous RF treatment, followed by a microneedle RF treatment, produces a dense 3-D crisscross pattern of thermal injury, resulting in enhanced skin tightening, wrinkle reduction, and fat ablation above and beyond that of each modality alone. This complex meshwork of RF thermal injury has a robust impact on the dermis, subcutaneous fat, and the fibro-septal tissue network. When this tissue remodels as it heals and neocollagenesis occurs, the ensuing outcome is a tightening of tissue in multiple different directions, levels, and planes—a result not possible with either of these treatments alone.

In the authors’ practice, the ideal patient for this synergistic, dual treatment technology is one whom has been deemed non-surgical and has one or more of the following aesthetic conditions: moderate sagging in the system, as well as improvements in nasolabial folds. Post-treatment oedema lasted approximately 3-4 weeks following treatment, and continued improvements were observed for an additional 6 months after treatment. Patients reported only mild discomfort post-operatively, and social engagement limiting oedema/swelling was present for 5-7 days. There were no burns or major complications, and patient satisfaction scores averaged 4.6/5.

With this changing aesthetic landscape, both microneedle and percutaneous RF technologies have the potential to revolutionize the practice of the aesthetic clinician with respect to face and neck rejuvenation.
neck and/or jawline, thin skin thickness, mild platysmal banding, ‘crepe’ neck skin, or poor skin elasticity. This patient phenotype is completely different from the patients that are otherwise chosen to have either percutaneous RF or RF microneedling treatment alone (Figure 4 A-B and Figure 5 A-B). Additionally, the two procedures can be combined in a single office visit with a one-time tumescent anaesthesia session, benefiting both practitioner and patient preference. When performing these procedures in the office, the percutaneous RF treatment should always precede microneedle RF treatment, as tumescent anaesthesia will have already been administered in their lower face and neck in advance of the RF microneedling treatment.

Finally, from a practice building and financial standpoint, the combination of these RF treatments can be extremely profitable. The total procedure time is only nominally longer with the addition of the microneedling RF treatment, and this second procedure proceeds significantly faster because the physician is not waiting for the anaesthesia to take effect. The only additional cost is the price of the disposable tip or pins for the RF microneedling device. By coupling the procedures, the physician benefits financially from these two high margin procedures and the patient benefits from the improved synergistic results.

**Conclusion**

The combined results achieved with these non-surgical devices is unlike any other treatment on the market. The neck and lower face tightening produced with these synergistic technologies is truly impressive, and even as recently as a few years ago, the outcomes now possible through combinational RF therapy could have only been achieved through surgery. The addition of these procedures to the practice of aesthetic surgery has opened the door to many patients who are not willing to undergo lower face and neck surgery but are still looking to achieve significant clinical results in this treatment area.

**Declaration of interest**

Jason D. Bloom is on the speaker’s bureau and an advisor to both ThermaAesthetics and InMode.

**Figures 1, 2, 4 & 5 © Jason D. Bloom, 3 Courtesy of InMode**

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**References**