SVC™ Technology Advances Fractional RF Systems for Improved Control and Comfort

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ABSTRACT: Traditional skin resurfacing methods lead to remodeling of the dermal extracellular matrix but they are associated with significant down-time periods and post-operative complications. Fractional RF devices are minimally invasive systems that deliver a bipolar RF current through an electrode assembly. Viora's Fractional handpieces represent a new generation of fractional RF devices which is suitable for more difficult to treat areas, such as the neck, décolleté and hands, thanks to its patented SVC™ technology. The SVC™ technology stands for the combination of Switching, Vacuum and Cooling mechanisms which enhances clinical results, patients' safety, and maximizes patients' comfort, beyond that which can be achieved with existing fractional RF systems.

Introduction

Traditional skin resurfacing methods - chemical peelings, skin dermabrasion and ablative lasers resulting in epidermal removal and dermal wounding - lead to remodeling of the dermal extracellular matrix. Although these methods are found to be effective, they typically require a significant down-time period [1, 2] that may last about 1-2 weeks, during which time there is swelling, oozing and crusting [3]. In addition, these methods are also associated with post-operative complications such as scarring, infection, and dyspigmentation. Alternatively, fractional systems, in which the dermal effect can be accomplished sparing the epidermis, have lower post-operative complications and a much shorter down-time [1, 2].

Fractional RF devices are minimally invasive systems that deliver a bipolar RF current through an electrodes assembly [1] which produces an injury pattern with uninfected areas between them. The created injury stimulates wound healing processes which lead to dermal remodeling. As a result, improvement in the tone and texture of the skin, smoothing of lines and wrinkles, reduction in pigmentations and improvement in scars (particularly acne scars) are detectible [4]. Several studies with fractional RF systems further supported the assumption of wound healing responses by showing histological evidence of neocollagenesis and elastin replacement with rising extracellular matrix and increase in reticular dermal volume, cellularity and hyaluronic acid [5].

V-FR Handpiece

Viora's V-RF handpiece represents a new generation of fractional RF devices for aesthetic and dermatological skin resurfacing and rejuvenation. The system combines two treatment tips for large and small areas, and is suitable for more difficult to treat areas, such as the neck, décolleté and hands. V-touch's utilization of patented SVC™ technology provides a significant advance in treatments over the current fractional RF systems on the market.

SVC™ Technology

SVC™ technology stands for the combination of Switching, Vacuum and Cooling mechanisms which enhances clinical results, patients' safety, and maximizes patients' comfort, beyond that achieved with existing fractional RF systems.

Switching

The Switching technology enables dual functionality, in which it is possible to reduce skin impedance before the fractional pulse and selectively choose depth penetration of the RF current.

The first feature of the switching technology is the **"Smart Heat"** pulse. The "smart heat" function creates volumetric heating of the target area (**Fig. 1**) before releasing the fractional pulse. Since the tissue conductivity of RF energy is significantly correlated to tissue temperature, an increase in skin temperature lowers skin impedance and consequently the target tissue is selectively heated by the RF current [6]. In other words, pre-heating of the target tissue by "smart heat" increases skin conductivity prior to the fractional pulse and reduces the energy levels needed, thereby reducing patients' pain levels and post-operative complications or side effects.

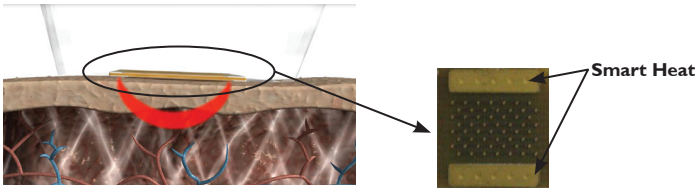


Figure 1. Bulk heating related to the "smart heat" function is achieved by activation of non-fractional electrodes prior to the fractional pulse.

The second feature of the switching function controls RF penetration by switching and pairing fractional rows at different distances. As the distance between the electrodes directly influences the depth penetration of RF energy [6], the ability to control the pairings allows accurate targeting of the desired skin layer. This function is performed via three programs: **Shallow, Medium** and **Deep** and provides a significant measure of control to treatments.

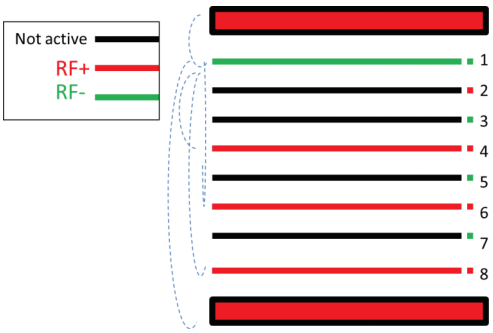


Figure 2. Schematic representation of switching technology

Ex-Vivo experiments on swine skin using a thermal camera showed the switching technology is able to penetrate different skin depths in direct correlation to the distance between the electrodes rows (**Fig. 3**).

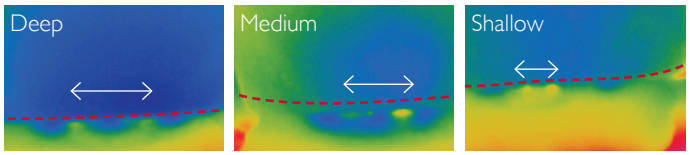


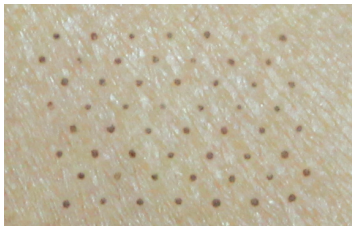
Figure 3. Thermal images of swine skin cross-section, using Shallow, Medium and Deep programs. The red broken lines represent the end of the fractional tip. White arrows designate the activated rows of electrodes.

Vacuum

The integrated vacuum mechanism inside the fractional RF tip creates safer, more comfortable and more accurate treatments. The vacuum pulse begins before the RF energy is released and continues throughout the RF pulse to ensure proper coupling is achieved and maintained. The vacuum therefore contributes in three major aspects:

a. Ensuring proper coupling of electrodes to the skin eliminates "bad coupling" which minimizes the risk of epidermal burns.
b. Reduction of pain levels due to the mechanical force applied to the tissue. The vacuum-induced skin flattening creates pressure on the nerves of the skin which leads to significant pain reduction [7]. According to Viora's preliminary results, the pain level drops dramatically, from 6-7 (in the VAS scale) to 0-1, after introducing the vacuum technology.
c. Obtaining more equal, consistent and symmetrical injury points due to the stretching of the skin (**Fig. 4**).

Figure 4. Injury pattern 4 days post fractional RF treatment (human skin).



Cooling

The SVC™ technology introduces a cooling function to the treatment area which contributes to safer, better tolerated treatments. The epidermal cooling assures protection of the superficial skin layers; a fact that is supported by several studies addressing the safety and efficacy of clinical results. By lowering the epidermal temperature (**Fig. 5**), a higher power of RF energy can be applied without producing any epidermal damage. In addition to reducing the intra- and post-operative adverse effects, the cooling feature also contributes to the reduction of pain [8]. Moreover, cooling was shown to not have any effect on long-term results, as well as reducing the recovery period [9].

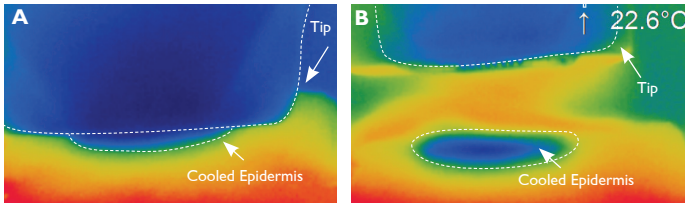


Figure 5. Thermal images of swine skin cross-section, using cooling technology. Figure A shows the cooling effect on the epidermal layer during the treatment. Figure B shows that the epidermis remained cooled after the fractional RF pulse, pointing to superficial skin protection.

Despite general belief that superficial cooling may reduce the heating effect due to lowering the epidermal temperature, the depth of the heat generation can be controlled by choosing various treatment parameters [10] including the energy level, switching pattern, "smart heat" and pulse duration. Moreover, simultaneous epidermal cooling and deep volumetric tissue heating allows sustained delivery of higher energy in a single treatment [11]. As previously discussed, if the temperature of the target tissue is higher than that of the surrounding tissue, then the RF current will be selectively focused to increase heating of the target tissue. Hence, the cooling itself drives electrical current inside the tissue, leading to an increase in penetration depth [6].

Conclusions

The minimally invasive fractional RF systems have lower post-operative complications and a much shorter patient down-time, compared with traditional skin resurfacing methods. The V-FR handpiece, with the unique patented SVC™ technology enables the selection of depth penetration of the RF current, reduces the amount of fractional RF energy needed and increases safety and patients' tolerance to the treatment due to the combination of the **Switching, Vacuum and Cooling** mechanisms.

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