CLASSYS

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MonopolarRF·HIFU : Customized Treatment Strategies from the Dermis to the SMAS



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As the use of radiofrequency(RF) and high-intensity focused ultrasound(HIFU) for skin lifting and tightening continues to expand, increasing emphasis is being placed not only on device performance but also on the method of energy delivery and treatment design. Even when using the same device, treatment outcomes and safety can vary substantially depending on how energy is distributed and delivered.

Beyond the conventional concept of dividing the skin into the epidermis, dermis, subcutaneous fat, and the superficial musculoaponeurotic system(SMAS), a more refine approach that considers the structural characteristics within each layer is required. In particular, the dermis is composed of the papillary dermis and the reticular dermis, each serving distinct biological functions.

The papillary dermis primarily contributes to improvements in skin texture, tone, and surface quality through the regeneration of type III collagen, whereas the reticular dermis enhances skin elasticity and wrinkle reduction through the regeneration of type I collagen. Accordingly, an effective treatment strategy should simultaneously target both the superficial and deep dermis dermal layers. Achieving this requires optimization of treatment parameters-including tip size, frequency, energy density, and power output-according to the anatomical characteristics of each treatment area.

Mechanism and Limitations of Conventional Monopolar RF

RF energy generates frictional heat by including the oscillation of molecules within biological tissues, thereby promoting collagen denaturation and subsequent neocollagenesis. Initially, collagen contraction produces an immediate lifting effect, Subsequently, collagen remodeling continues over the ensuring months, leading to gradual and sustained improvement.

However, not all RF treatments produce equivalent outcomes. The method of energy delivery is a key determinant of treatment outcomes. In conventional monopolar RF systems, energy isn't distributed uniformly and tends to concentrate at the edges. This edge concentration increases the risk of adverse effects, including pain and thermal burns. Although the subcutaneous fat layer is not the primary target of RF energy, it may be indirectly affected by heat conduction from adjacent tissues, potentially leading to localized fat atrophy. In clinical practice, pain in the perioral and jawline regions frequently leads to unexpected reactions, such as involuntary flinching, during treatment.

Furthermore, some conventional RF devices operate by dividing a single pulse into multiple sub-pulses interspersed with repeated gas-cooling cycles. As a result, continuous pulse delivery and cooling cannot be maintained, allowing heat to accumulate during specific phases of treatment and potentially increasing the risk of thermal injury.

Evolution of VOLNEWMER's Motion and Cooling Technologies

To overcome the limitations of monopolar RF treatment, in which heat may accumulate in specific areas and increase the risk of thermal injury, the importance of the moving technique should be emphasized.

Whereas the conventional stamping technique repeatedly delivers energy to the same treatment area, potentially causing localized overheating and increased pain, the moving technique disperses energy, thereby reducing pain and allowing a greater cumulative amount of energy to be delivered safely. Another strategy involves dividing a high-energy pulse into two sequential deliveries. Whereas the conventional stamping technique limits the use of maximum power output because of localized heat accumulations, the moving technique enables the safe application of maximum power, thereby enhancing treatment efficacy while minimizing pain and treatment related adverse events.

Continuous pulse delivery and cooling are essential for the efficacy and safety of the moving technique. While gas-cooling systems provide rapid but intermittent cooling, VOLNEWMER's continuous pulse delivery and water-cooling technology maintain a stable temperature, enabling more consistent and controlled energy delivery.

Comparative studies have shown that continuous water-cooling technology yields superior improvements in skin density, pore appearance, skin texture, and fine wrinkles, while also demonstrating a tendency to reduce treatment-related pain.

Furthermore, continuous water-cooling technology confines the cooling effect primarily to the epidermis without substantially affecting the dermis. This allows uniform energy delivery throughout the dermis, from the papillary dermis to the reticular dermis, thereby promoting favorable remodeling of both type I and type

III collagen.

HIFU Strategy and Combination Treatment Design with RF

HIFU delivers focused ultrasound energy to a predetermined tissue depth, enabling targeting of the dermis, subcutaneous fat layer, and the SMAS. However, the labeled focal depth of the HIFU cartridge does not necessarily correspond to the actual treatment depth. The actual depth of energy deposition may vary depending on factors such as skin thickness, subcutaneous fat thickness, and the amount of pressure applied during treatment. For example, although the 4.5 mm cartridge is generally considered to target the SMAS, it may actually have a greater impact on the subcutaneous fat layer in clinical practice. Furthermore, studies have shown that the 3.0 mm and 4.5 mm cartridges can increase dermal collagen content and improve dermal thickness, suggesting that the effects of HIFU are not confined to the intended focal depth but may extend to adjacent tissue layers.

These limitations may be overcome by combining HIFU with monopolar RF treatment. Monopolar RF improves skin texture, stimulates collagen remodeling, and enhances overall skin quality, whereas HIFU provides lifting, improves facial contours, and targets deeper tissue structures. RF treatment can be designed by applying a moving technique to deliver an appropriate amount of energy to volume-deficient areas, using stronger stamping in areas with abundant subcutaneous fat, and dispersing the energy in sensitive areas to potimized both efficacy and safety. In particular, for delicate areas such as the under-eye region, treatment should focus on improving skin quality rather than achieving strong lifting effects. In contrast, areas with abundant subcutaneous fat may require a more aggressive targeting approach.

Finally, energy design is perhaps the single most important factor determining treatment outcomes. Beyond simply selecting the appropriate device, successful treatment requires a comprehensive energy design that takes into account shot placement, energy intensity, delivery technique, and treatment depth. Only when these factors are harmoniously integrated can natural, long-lasting outcomes be achieved. Even with the same device, patient satisfaction can vary considerably depending on how the treatment is designed. Ultimately, the future competitiveness of aesthetic treatments will depend on how precisely energy can be designed and delivered.



Before and after combined Monopolar RF(VOLNEWMER) + HIFU treatment. Courtesy of Dr. Hyunseung Yoon.