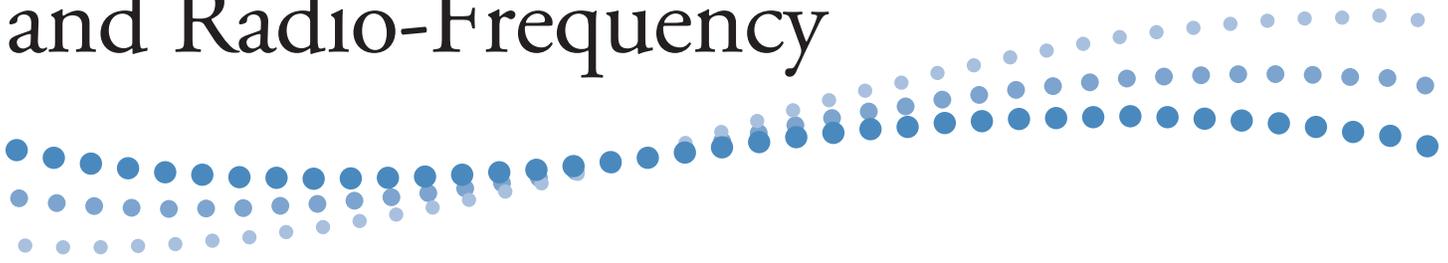


A SCIENTIFIC COMPARISON:

# Micro-Focused Ultrasound and Radio-Frequency



## MICRO-FOCUSED ULTRASOUND

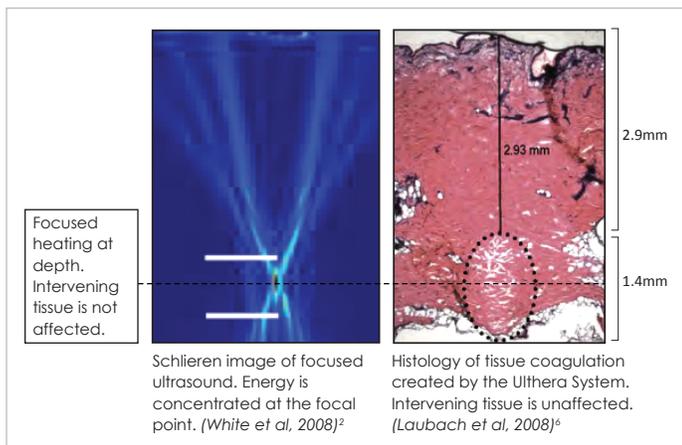
### How It Works:

Ultrasound is a mechanical form of energy that uses sound waves for both imaging and treatment. When sound waves are micro-focused to a point, they cause the “creation of well defined thermal injury zones (TIZs) at depths within soft tissue while leaving the surrounding regions unaffected... The ultrasound waves induce a vibration in the composite molecules within tissue during propagation, and the friction developed between intrinsic molecules is the source of the generated heat.”<sup>1</sup>

### Properties:

#### Depth: Optimal Depth of 4.5mm for Tissue Lifting

Because of its mechanical properties, ultrasound is the only energy source that can be micro-focused below the skin's surface at any depth, without affecting intervening tissue. The Ulthera system precisely heats tissue at 3 discrete depths (1.5, 3.0, 4.5mm), targeting a deeper tissue plane than any other facial aesthetic technology. Treating on the face at 4.5mm contracts the SMAS and platysma layers, resulting in a non-invasive lift without affecting the skin's surface.



#### Temperature: Optimal Temperature for Neocollagenesis (60-70°C)

Clinical studies demonstrate that collagen contraction and denaturation are optimized at temperatures between 60 - 70°C.<sup>4</sup> The Ulthera® System is the only device that reaches these optimized temperatures at depth, without causing surface effects. The ultrasound energy is micro-focused to a point below the skin's surface, consistently heating tissue at the focal point to ~68°C. This heat causes collagen contraction and denaturation, and initiates aggressive neocollagenesis.

## RADIO-FREQUENCY

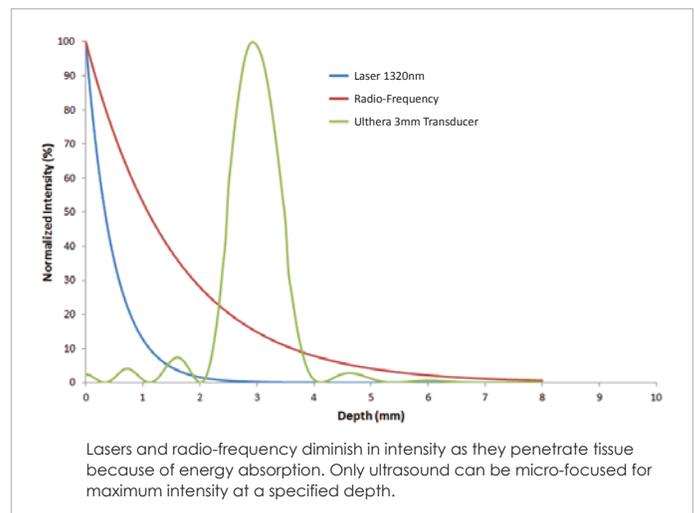
### How It Works:

Radio-frequency (RF) is an electromagnetic form of energy. RF devices create an electrical field within tissue that heats through resistance. “As the charge of the electrode changes from positive to negative at a rate of 6 million times a second... the resistance in the tissue to the movement of these charged ions and molecules in the skin and subcutaneous tissue causes heat.”<sup>3</sup>

### Properties:

#### Depth: Depth of 2-3mm; Only Affects the Dermis

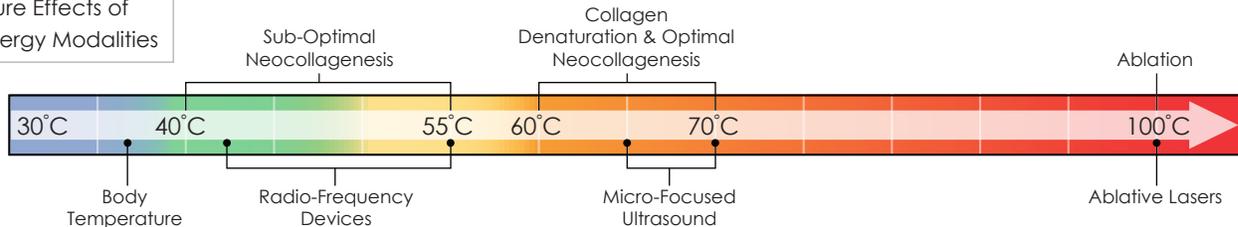
Radio-frequency is limited to delivering efficacious heating to depths of approximately 2-3mm. The maximum energy intensity is delivered at the skin's surface, and diminishes through tissue absorption as it penetrates deeper. Unless cooling is used, heat at the skin's surface must be limited to prevent adverse effects, which further reduces the depth that efficacious temperatures can reach.



#### Temperature: Sub-Optimal Temperature for Neocollagenesis (40 - 55°C)

Radio-frequency devices heat tissue to between 40 - 55°C. This wide range of temperature results from inconsistencies in treatment variables such as energy setting, tissue properties (*impedance of fat vs. tissue*), and application time (*partially a factor of patient discomfort*). RF devices that reach dermal temperatures above 43°C must provide epidermal cooling to prevent adverse surface effects. The majority of RF devices do not provide surface cooling, which limits the maximum surface temperature they can reach to below 43°C, resulting in even lower temperatures as the energy penetrates the dermis.

Temperature Effects of Various Energy Modalities



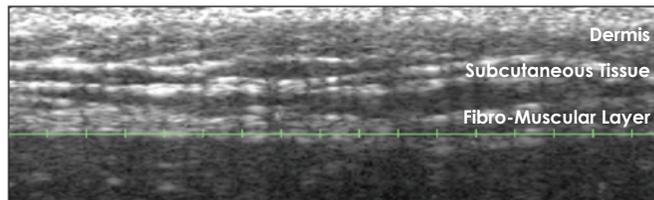
MICRO-FOCUSED ULTRASOUND

**Precision:** *Precise Energy Delivery + Visualization*

The Ulthera® System precisely and consistently heats tissue at a specific depth (1.5, 3.0 or 4.5mm) and temperature, with discrete spacing between Thermal Coagulation Points to promote healing. Real-time subcutaneous imaging also allows clinicians to control exactly where energy will be deposited, and avoid structures such as bone and major vessels. This enables consistent and reproducible treatment delivery and enhances patient safety.



**Precision Depth and Spacing of TCPs**  
 Histology of tissue coagulation created by the Ulthera System. White circles are Thermal Coagulation Points. Intervening tissue is unaffected. (Laubach et al, 2008)<sup>6</sup>



**Ultrasound Visualization:** Image from the Ulthera System screen showing subcutaneous anatomy and where energy will be delivered (green line).

RADIO-FREQUENCY

**Precision:** *Volumetric Heating of Tissue*

Non-invasive radio-frequency devices have a low degree of precision because they volumetrically heat tissue from the surface down. Variability in patient tissue properties, exposure time, technique and energy settings all affect the depth and temperature achieved during treatment. Because heat is applied volumetrically, it is impossible to selectively treat at specific depths without affecting the skin's surface and intervening tissue. This lack of precision inhibits consistent and reproducible treatment delivery.



Thermographic image of radio-frequency delivery into porcine skin. Skin cooling is being applied and the heating depth is approximately 2mm. (Pope et al, 2005)<sup>3</sup>

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