Radiofrequency Technology in Face and Neck Rejuvenation

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KEYWORDS

• Skin tightening • Facial contouring • Radiofrequency • Microneedle radiofrequency • Catheter-based radiofrequency • Monopolar • Bipolar • Multipolar

KEY POINTS

- It is important to select the best radiofrequency (RF) device type to ensure the best clinical outcome for the face and neck.
- RF device types can range from monopolar, bipolar, or multipolar to multi-generator.
- Thermal devices, such as RF, affect the tissues at the molecular level.
- It is the biochemical and bio-thermal processes' effect on soft tissues that produces an aesthetic improvement.

Panel discussion

1. What is your perception of how thermal devices, such as radiofrequency (RF), affect the tissues at the molecular level, ultimately resulting in the biochemical and bio-thermal processes' effect on soft tissues that constitute an aesthetic improvement?
2. Based on cellular death paradigms, how can we explain the effects that ultimately occur after exposure to RF because of the hyperthermal environment? Specifically, what role do pyroptosis (electroporation) and apoptosis play in addition to coagulative necrosis? Do you think fractional microneedle RF provides a level of mechanical poration of adipose cells in addition to electroporation of cell membranes.?
3. Monopolar, bipolar, multipolar, and multi-generator RF for the face and neck: How do you select the best RF device type to ensure the best clinical outcome?
4. Do you agree or disagree with the following: Using the same number of RF treatments and the same type of RF device in the face and neck guarantees homogeneous skin tightening effects?
5. What are the best ways to address tissue selectively in the face and neck with RF?
6. What temperatures are indicated for nerve ablation, tissue tightening, skin rejuvenation, and stimulating an inflammatory response?
7. How have you changed your use of energy-based technologies over the last 5 years?

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1. What is your perception of how thermal devices, such as radiofrequency, affect the tissues at the molecular level, ultimately resulting in biochemical and bio-thermal processes' effect on soft tissues that constitute an aesthetic improvement?

GENTILE

Radiofrequency (RF) devices work differently from optical lasers and photo-modulation. When laser light is delivered to the skin, there is an associated upregulation of matrix metalloproteinases that leads to a cellular response in the dermal collagen of the skin occurring either via water and collagen absorption of the light leading to a thermal effect on the dermis or through the production of growth factors and cellular mediators as a result of the light energy interacting with the hemoglobin and melanin within the skin. It has been postulated that nonablative lasers cause an increase in the production of type I procollagen messenger RNA (mRNA) associated with the tissue response occurring within the dermal matrix.

RF energy, on the other hand, uses resistive heating within the various layers of the skin to transform the RF energy given to the skin into thermal energy.[1–3] Resistive heating is also described as dielectric heating in which a high-frequency alternating electric field with associated magnetic fields or radio wave or microwave electromagnetic radiation heats a dielectric (polar) material. At the molecular level though, the total charge on a molecule is zero; the nature of chemical bonds is such that the positive and negative charges do not completely overlap in most molecules. Such molecules are said to be polar because they possess a permanent dipole moment. A good example is the dipole moment of the water molecule (**Fig. 1**). At higher frequencies, this heating is caused by molecular dipole rotation within the dielectric polar molecule. When no electric field is present, the molecules are randomly oriented. When the field is turned on, the molecules tend to line up with their negative ends toward the positive pole and their positive ends toward the negative pole. The oscillation of polar molecules produces frictional heating, ultimately generating the thermal effects to adjacent tissues in the electromagnetic field.

Many considerations are required for there to be successful transfer of the RF energy into thermal energy, including the size and depth of the tissue being treated, as one needs to consider the tissue impedance of the skin being treated. Because RF energy produces an electrical current instead of a light source, tissue damage can be minimized and epidermal melanin is not damaged either. With this knowledge, RF energies can be used for patients of all skin types, that is, it is color blind and allows for different depths of penetration based on what is to be treated, allowing for ultimate collagen contraction and production of new collagen as well as elastin and hyaluronic acid.[4]

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The basic mechanism of RF interaction with tissues is the induction of a current through charged molecules and ions in the intracellular and extracellular tissues. Several factors influence the electrical impedance, including hydration, extracellular water content and the presence of fat, muscle, protein, and nervous tissue. Each tissue conducts electricity variably

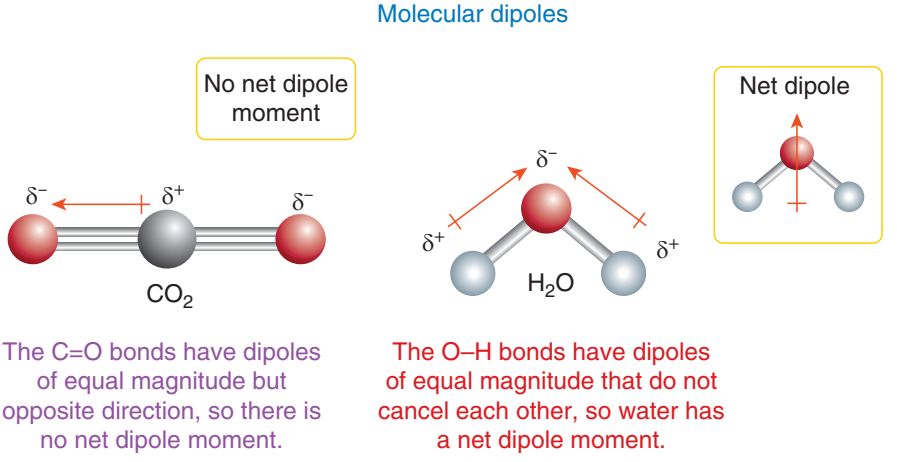

Fig. 1. Dipole moment of the water molecule.