

# RF Safety & Science

May 7, 2021

Confidential

The Science & Safety behind Radiofrequency  
Aesthetic Treatments



CYNOSURE® BEAUTIFUL  
ENERGY



# Learning Objectives



● Radiofrequency Overview

● RF Facial & Body Treatments

● RF Surgical Applications

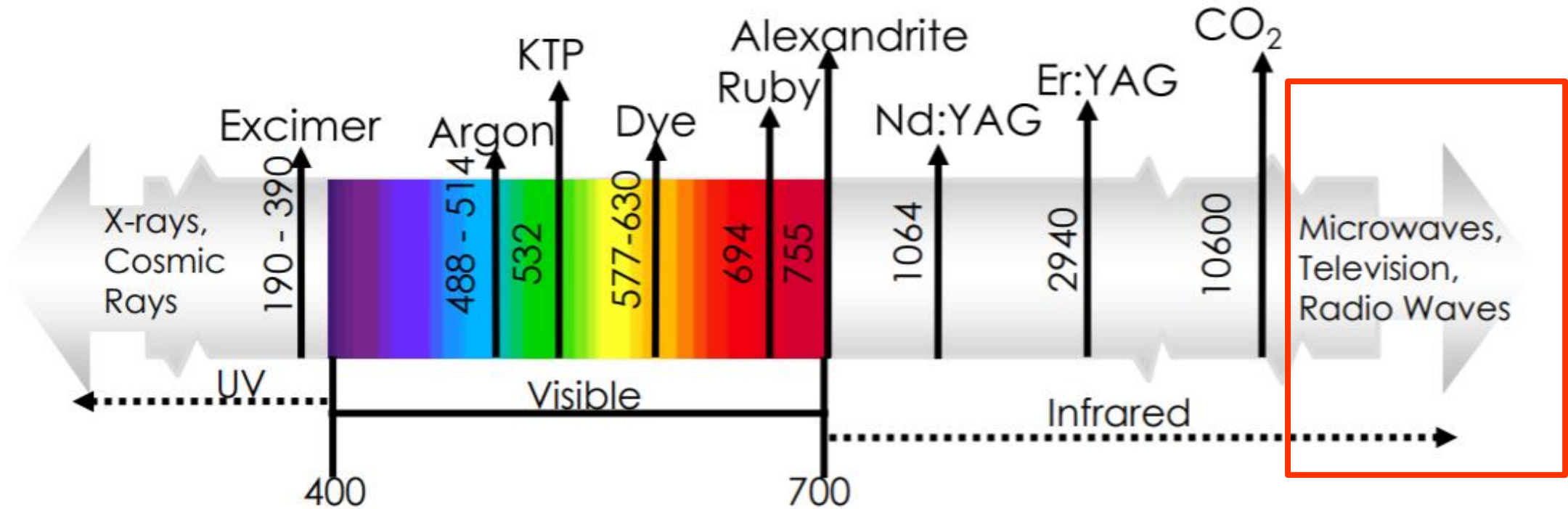
● RF Safety Guidelines for Face & Body

● RF Safety Guidelines for Surgical

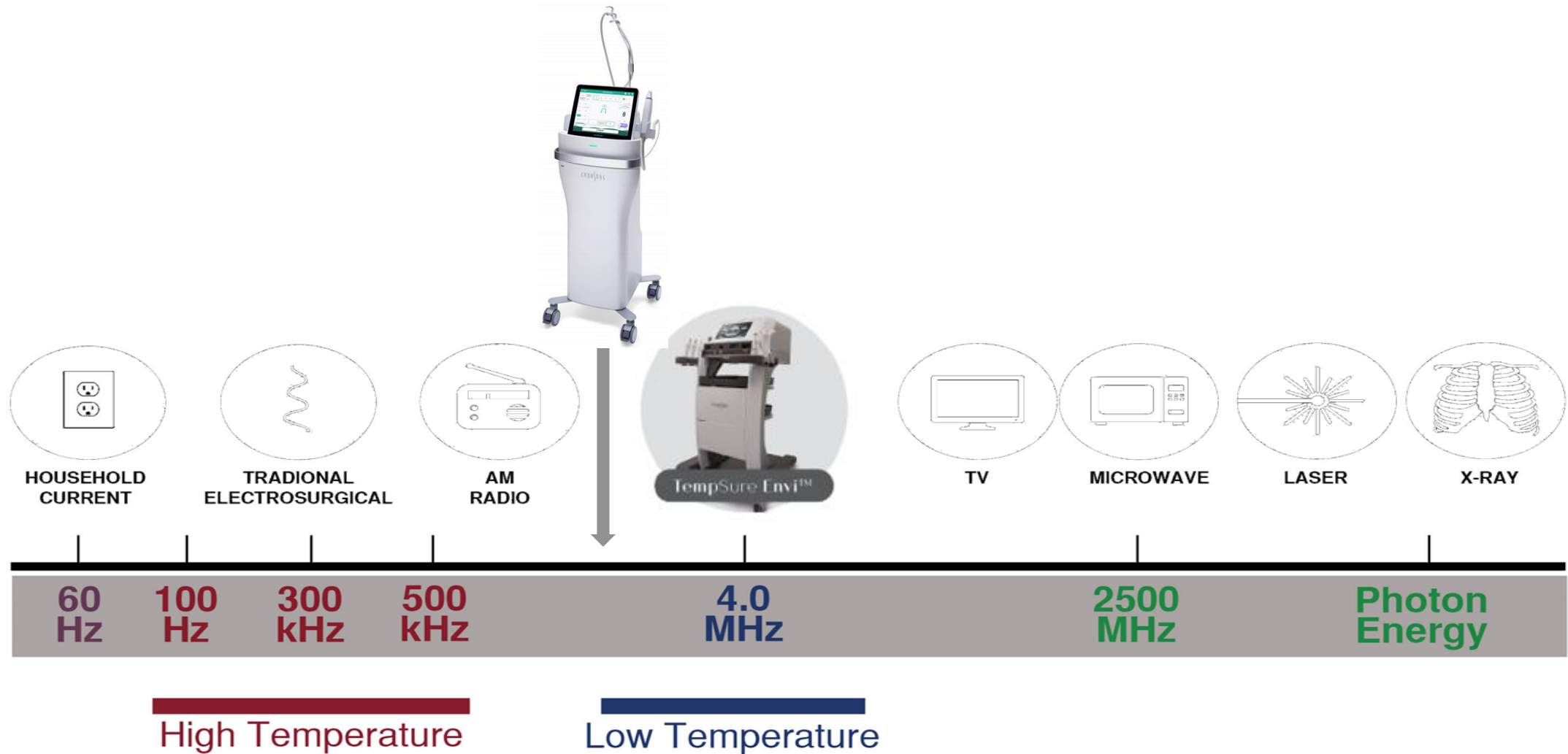
# What is Radiofrequency?

- Radio Frequency (RF) is part of the electromagnetic spectrum characterized by a specific frequency measurable in Hertz (Hz).
- RF can be delivered in different manners such as bipolar, monopolar, fractionated, and non-fractionated.
- RF has a low risk of complications and a high safety profile.
- RF energy produces a change in the electrical charges of the treated skin creating an electron movement. The resistance (impedance) of the tissue to that electron movement generates heat.
- Does not target specific chromophores and can safely treat all skin types

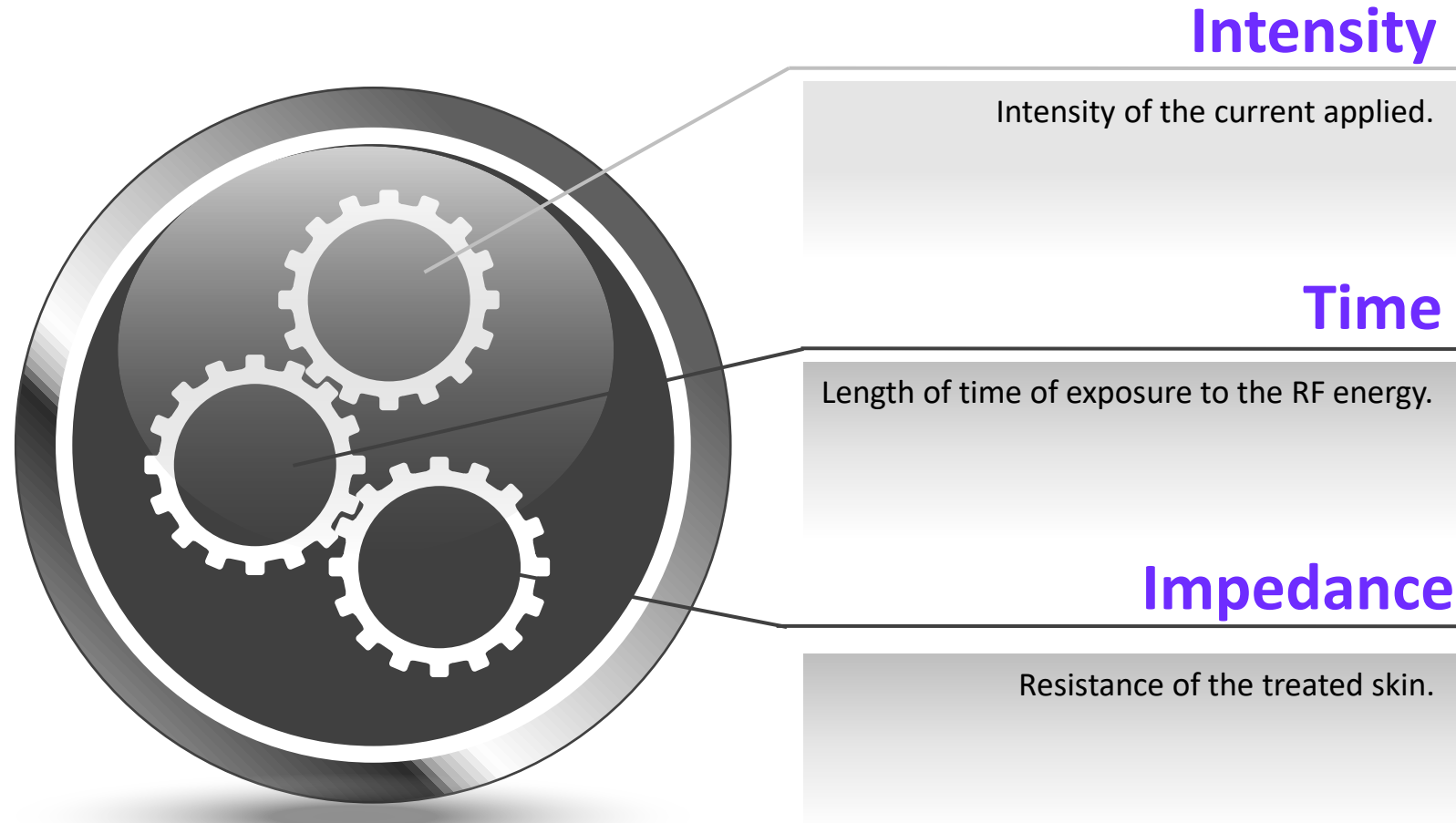
# Electromagnetic Spectrum



# Radiofrequency Spectrum (measured in Hz)



# Amount of heat is dependent on 3 factors

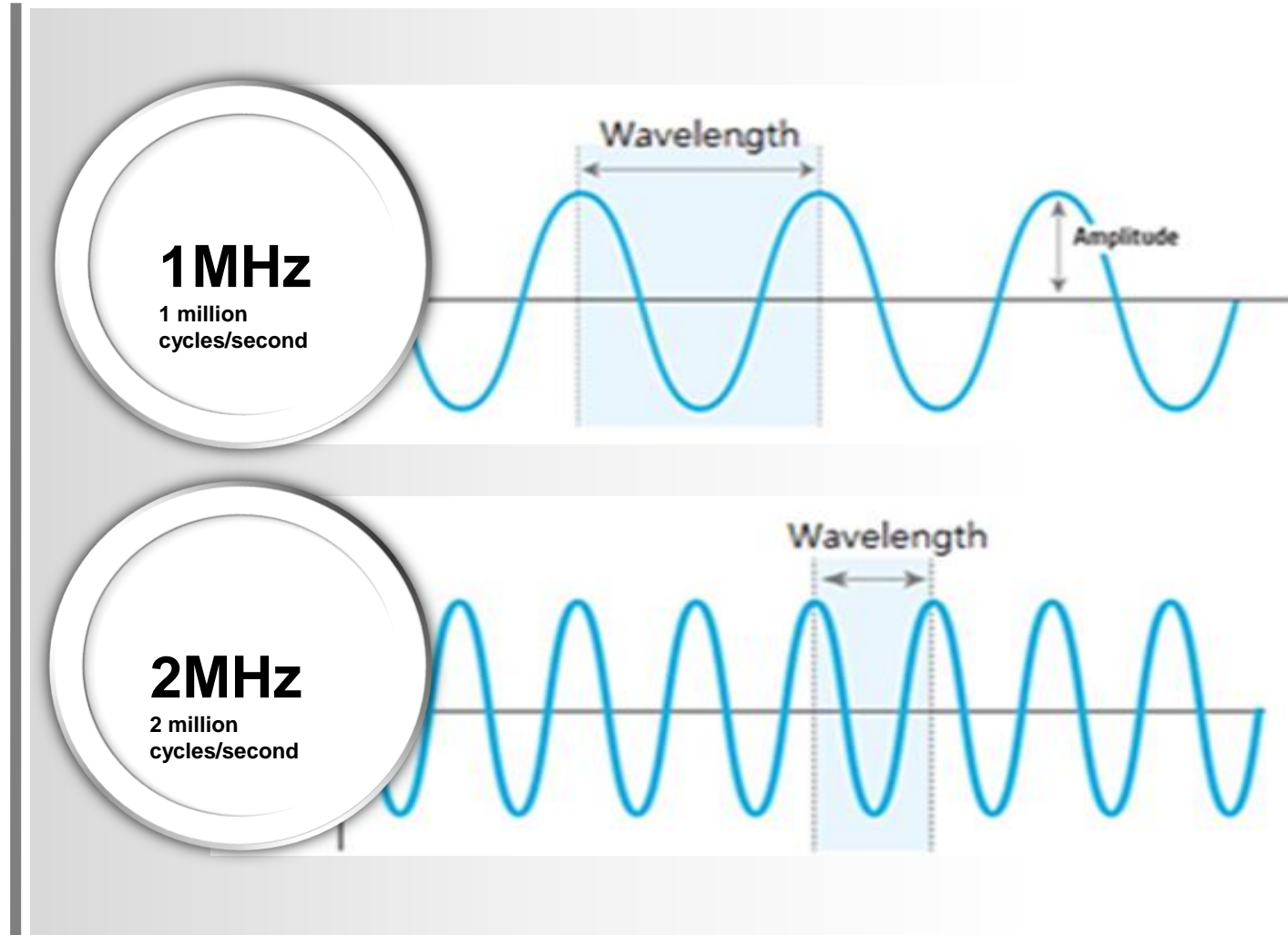


# Frequency

Higher frequency energy is more quickly absorbed by molecules than lower frequency energy.

The rate of energy absorption also depends on the tissue type and hydration content.

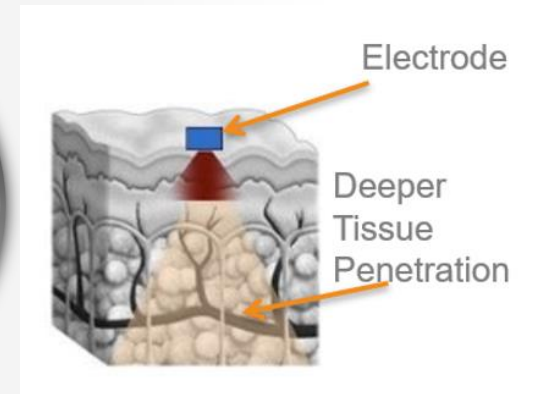
High frequency simply means there are more cycles per second.



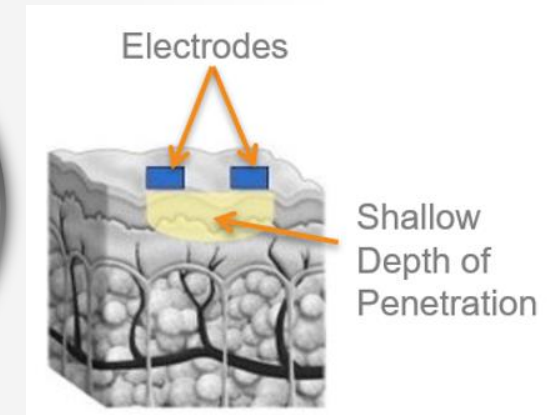


# Monopolar versus Bipolar RF

- Current between active treatment electrode and passive ground electrode (Neutral pad)
- Lower energies- no pain, minimal adverse events
- High penetration of the emitted current



- Current passes between 2 electrodes
- Limits current to area between electrodes
- Depth of penetration equals half the distance between electrodes
- Shallow tissue heating and less intensity than monopolar RF





# Impedance | Resistance within the tissue

Ohm's Law

- RF generates heat as a result of tissue resistance or impedance to the electromagnetic current. The electrical current to thermal energy due to tissue impedance can be defined by Ohm's Law.
- The delivery of RF energy is a function of time and temperature to allow for maximum epidermal protection while optimally heating the dermal collagen.



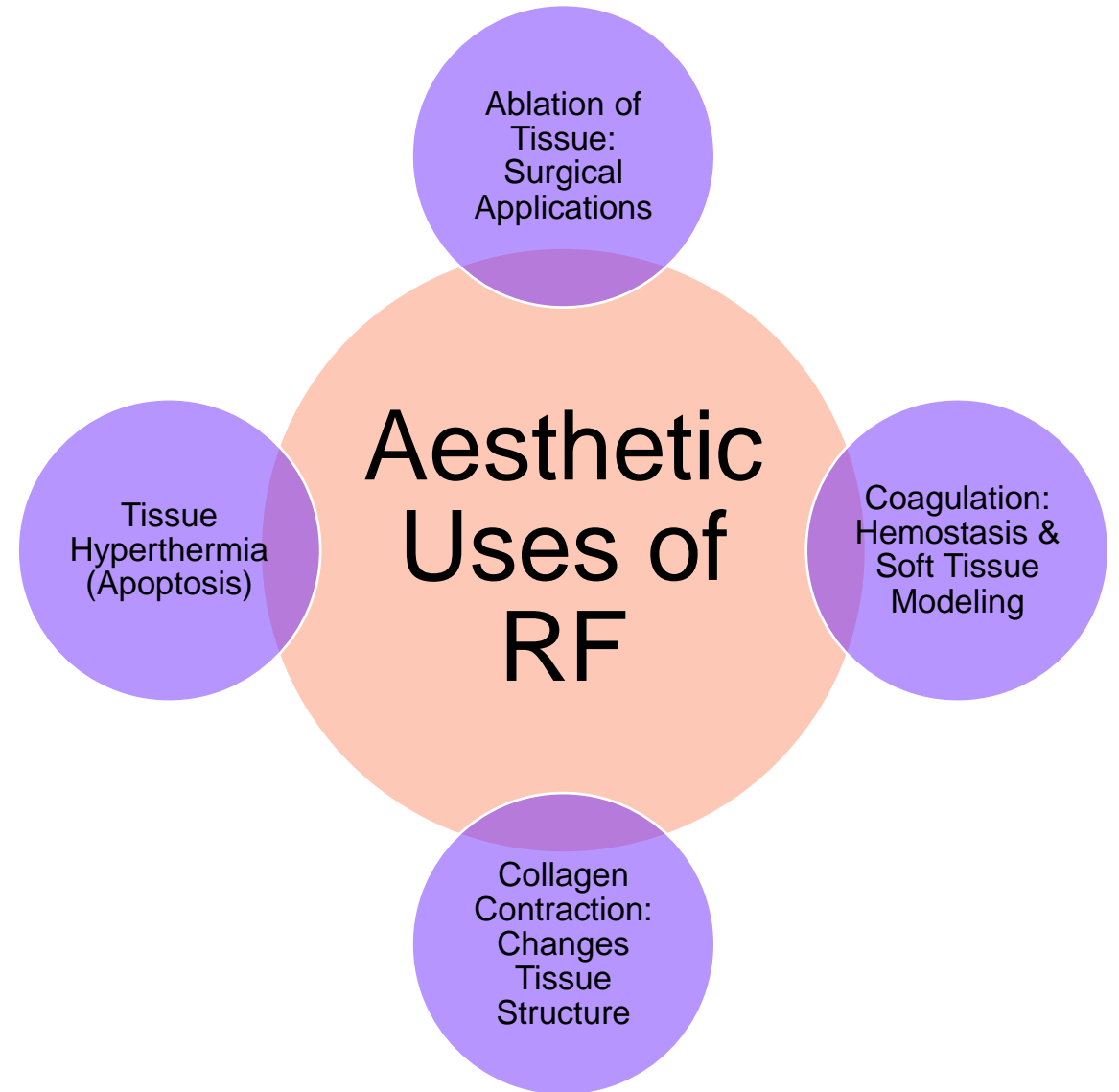
# RF Facial & Body Treatments

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# Thermal Tissue Change

- RF treatments induce a thermal effect in tissue
- RF uses high-frequency currents causing oscillating motions of ions found in body fluids
- The effect of this motion is friction of neighboring particles and production of endogenous heat in tissue



# How RF Remodels Collagen & Improves Elastin

## The Wound Healing Response

### Inflammatory Phase (1-3 days)

- Heat is applied to the epidermis
- Early contraction of blood vessels & vasodilation

### Proliferative Phase – 3 weeks

- Ongoing process to repair tissue
- Fibroblast activity is induced & synthesis of collagen begins

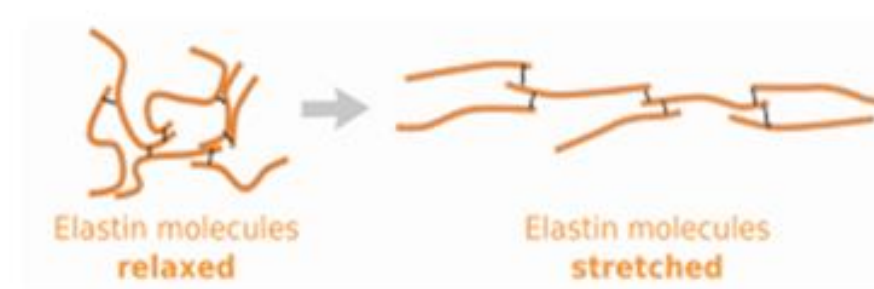
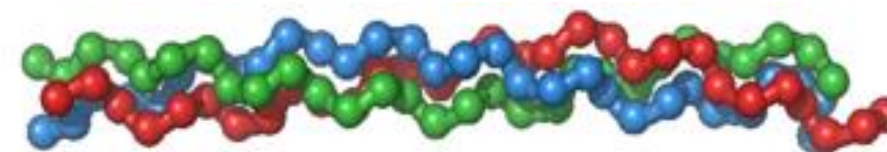
### Maturation Phase- 3 weeks to 6 months+

- New collagen is generated
- Elastin becomes more uniform & quality is improved

# Collagen & Elastin

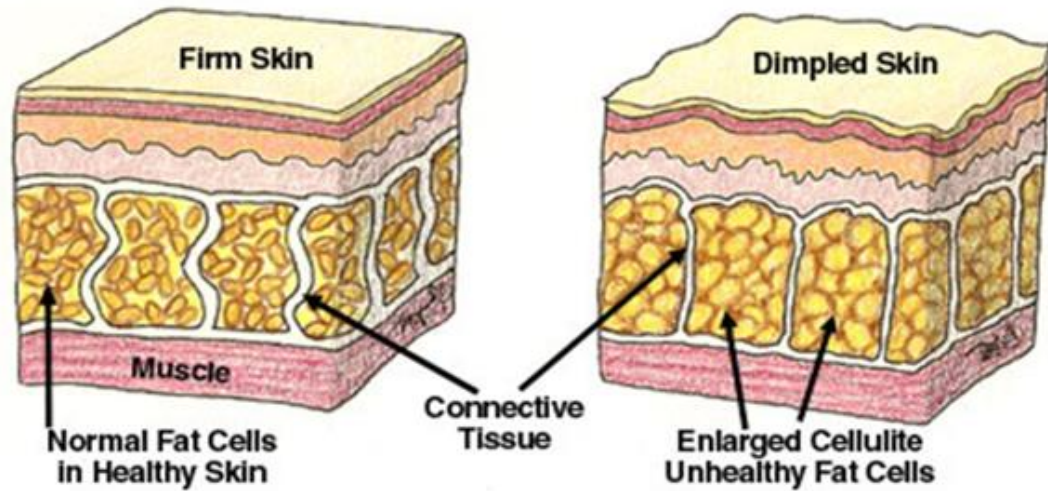
These two proteins work together to give skin its shape & firmness

- Collagen is tough and does not stretch easily. It provides strength to the skin and holds the skin together
- Elastin composes only 1-2% of the skin. It gives the snap or bounce-back reaction when skin is stretched, pinched or pulled, providing elasticity to the skin
- Collagen and elastin are both found in the papillary and reticular dermis



# Cellulite

Monopolar RF may be used for the treatment of cellulite



- Combined with massage, RF energy facilitates the movement of fluids into the interstitial space and eliminated by the lymphatic system
- Cellulite results from changes in the blood circulation & lymphatic system which cause structural changes in the subcutaneous adipose tissue, collagen & proteins
- As fat cells expand, the fibrous septae pull against sections of fat resulting in a dimpled appearance

# Tissue Heating

RF energy gently heats body tissue causing a therapeutic response





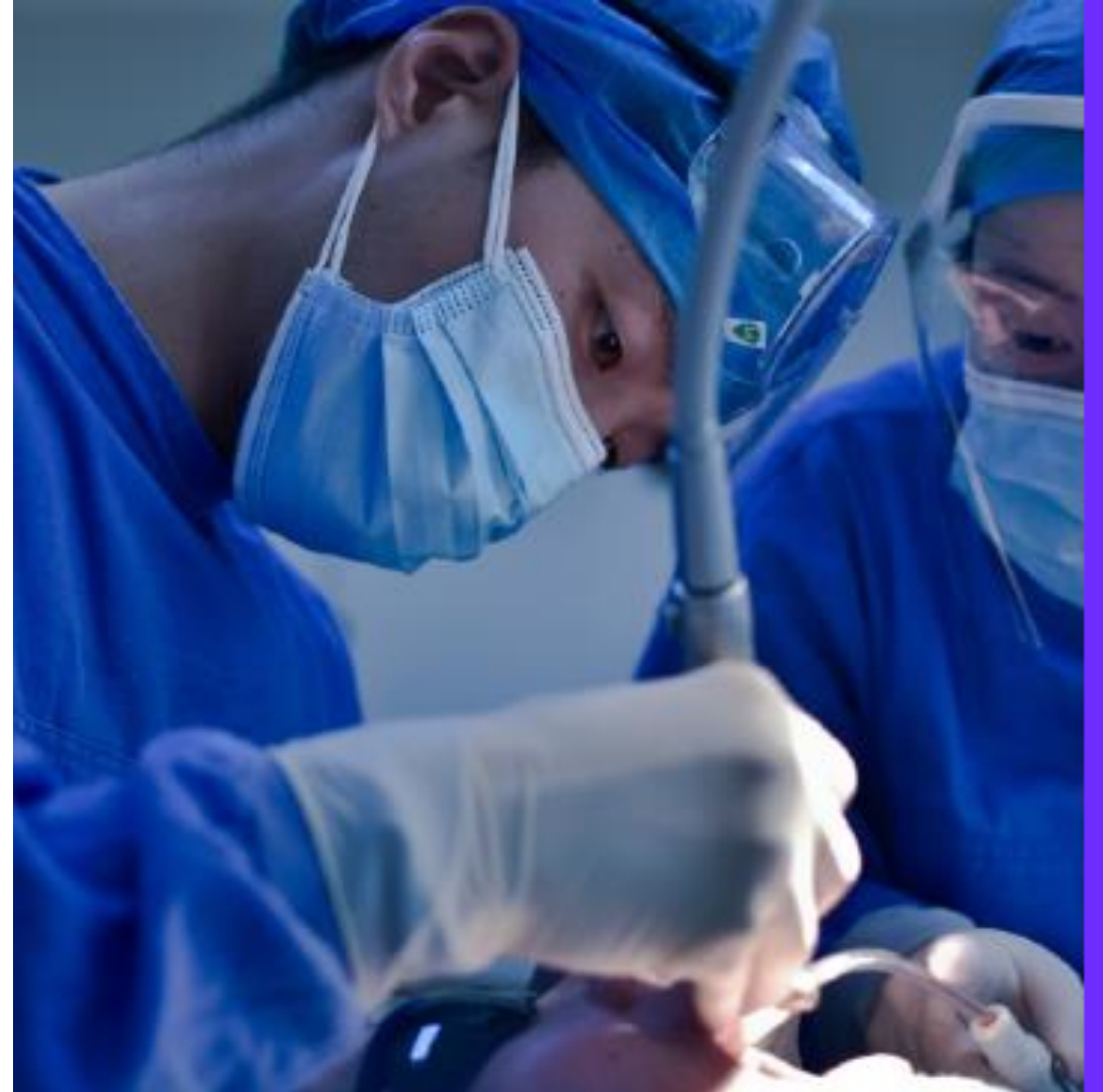
# RF Surgical Applications

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# RF Surgical Applications

- RF surgery utilizes energy created by a high frequency alternating current
- This allows consistent energy control & quick healing of tissue
- The resistance of the tissue to the passage of this current creates heat internally in the tissue, not in the active tip. The electrode remains cold. The energy creates molecular heat within each cell, volatilizing (creating a vapor) its water and splitting the tissue at the cellular level. This vapor serves to act as a coagulating factor in the treatment



# RF Surgery versus Electrocautery

## RF Surgery

- Heats tissue by passing a high frequency current through the tissue
- The tissue is the heated element by its impedance, the electrode is the means by which the current is introduced

## Electrocautery

- The tissue is heated using an electrically heated electrode
- The electrode is the heating element (like a branding iron)

# RF Surgical Advantages

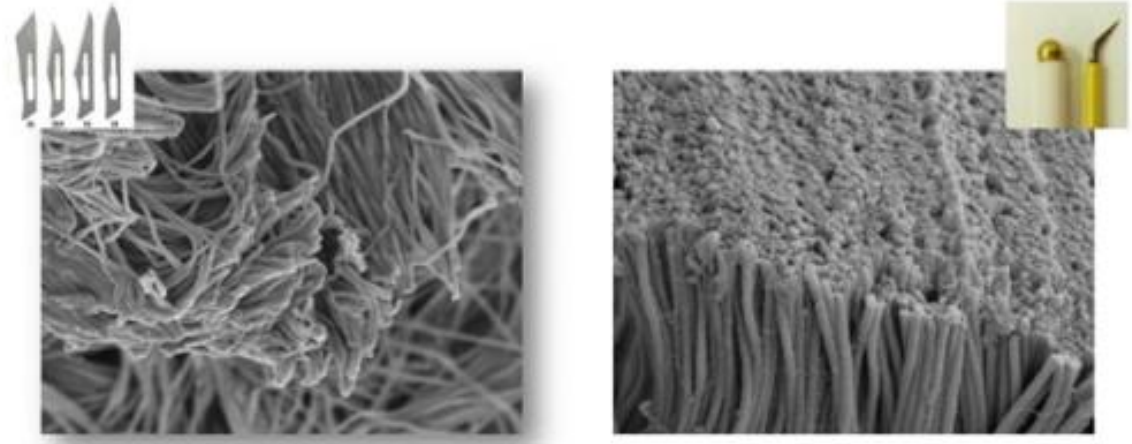
## Advantages to Surgeon

- Precise ability to sculpt mobile fleshy tissues
- More exact matching of incision edges
- Hemostasis while cutting/dissecting
- Faster procedure time
- Excellent wound healing

## Advantages to Patient

- Less swelling and bruising
- Rapid recovery
- Minimal discomfort
- Minimal scarring

**Cold Steel Knife vs. TempSure Surgical**



# Differences Between Surgical RF Waveforms

## CUT Mode

- Used to provide micro-smooth cutting with minimal cellular destruction.
- Ideal for skin incision, biopsy, and for cosmetic results

## HEMO or COAG Mode

- Used for coagulation and the shrinkage of tissue
- Ideal for epilation, telangiectasia, skin tags, cherry hemangiomas, seborrheic keratosis, and distichiasis

## BLEND Mode

- Used for cutting with hemostasis and ideal for sub-cutaneous tissue dissection
- Ideal in vascular areas

## BIPOLAR Mode

- Used for pinpoint micro-coagulation with minimal charring, tissue necrosis, or tissue adherence to forceps
- Ideal in coagulation in and around critical anatomy

# RF Lateral Heat Spread

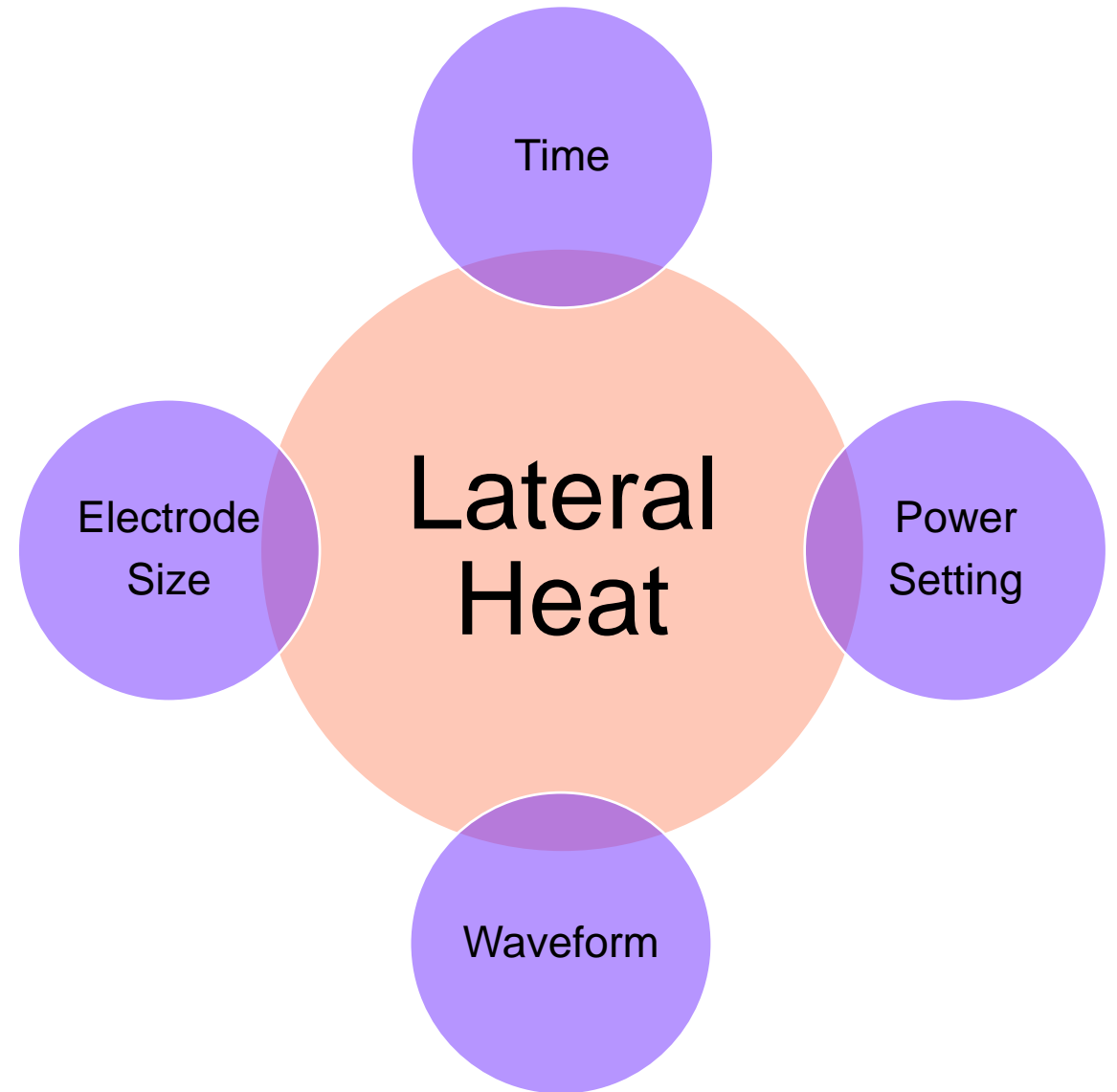
## 4 Factors that Affect Heat Produced

What can I change?

- T= Time electrode is in contact with tissue
- I= Intensity of power
- E= Electrode size or tip
- C= Nature of current (waveform)

What can I NOT change?

- F= Frequency range (higher frequency causes less tissue alteration) – a constant on the machine





# Electrode Size

- Assortment of sizes, shapes and lengths
- Depends on tissue to be incised
- Size proportional to power required

Small  
Electrode

- Higher current concentration
- Lower power
- Decreased lateral heat

Large  
Electrode  
or Loop

- More power
- More scar tissue
- More lateral heat

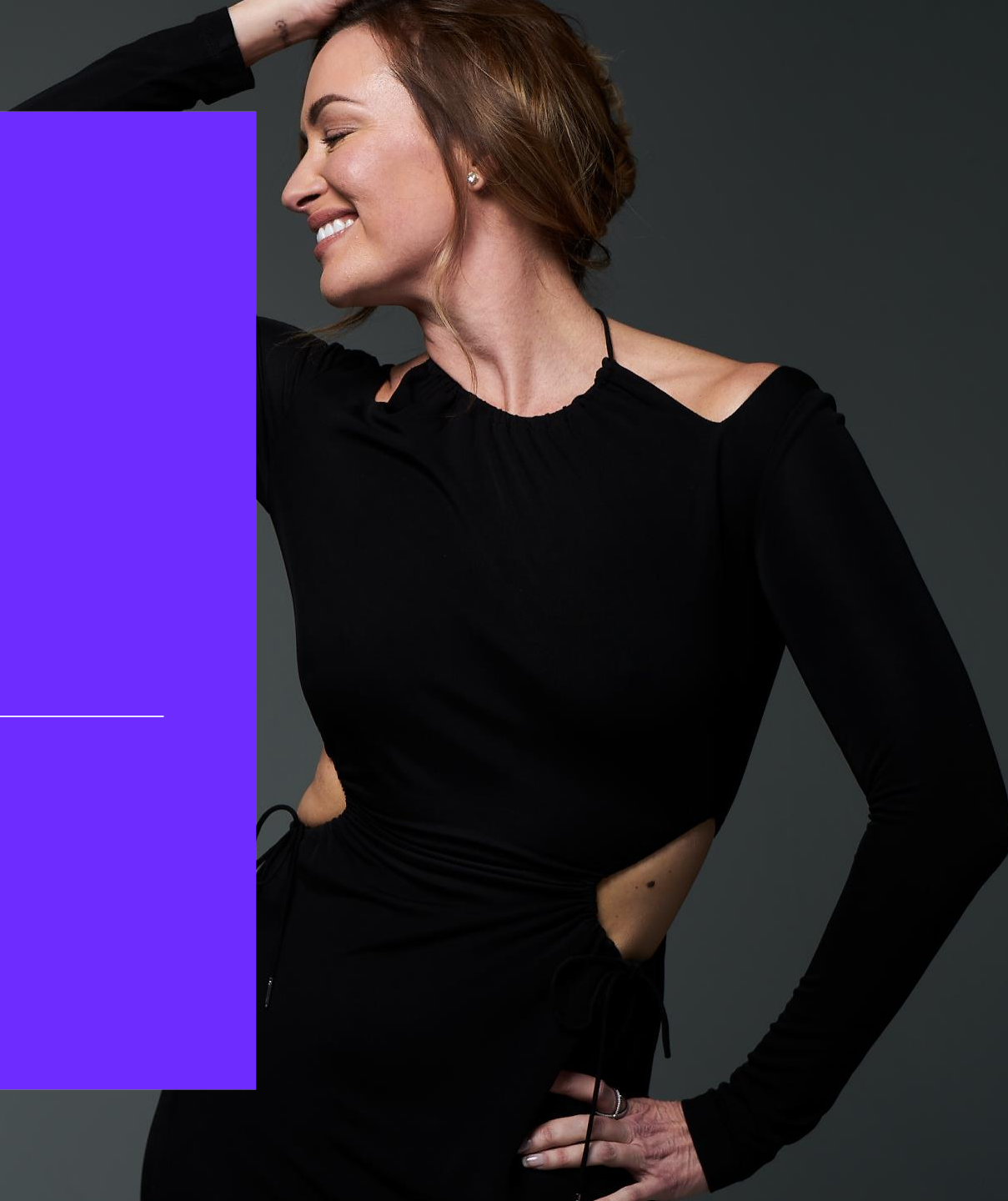




# RF Safety Guidelines

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Facial & Body Treatments



# Precautions & Warnings

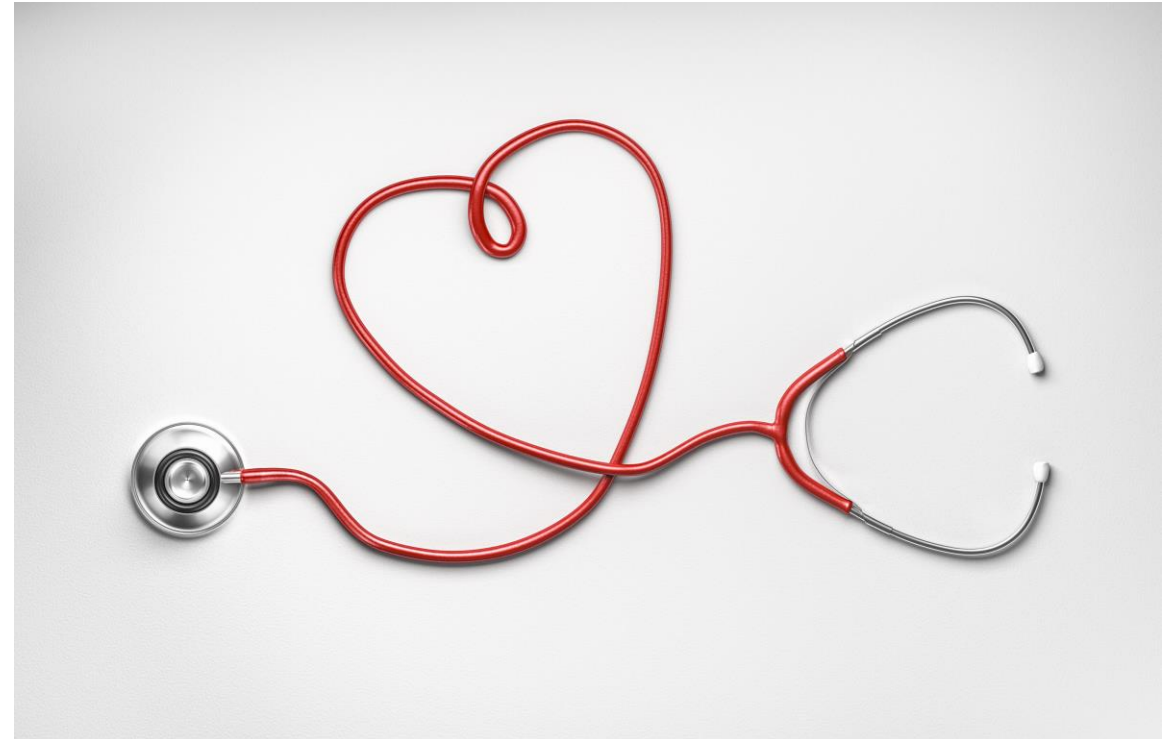
Including but not limited to the following:

- Pacemaker and/or ICD (Implantable Cardioverter Defibrillator)
- Any other implanted electronic device that gives or receives a signal
- Allergy to gold or corn
- Corneal eye shields (plastic, non-conductive) must be used for any RF procedure involving the eyelid & the immediate surrounding area
- Patients with nerve insensitivity to heat in the treatment area
- Do not treat on cut, wounded or infected skin
- Local, oral, or systemic anesthetic agents must not be used in treatment area
- Remove all jewelry and makeup
- Avoid treating and placing a NEM pad over tattoos and permanent makeup
- Beard stubble should be removed from the treatment area
- Operator to patient skin to skin contact should be avoided
- Metal implants in the electrical pathway (between the NEM and electrode)



# RF Devices have NOT been tested on the following patients:

- Pregnant & breastfeeding women
- Patients with autoimmune disease
- Diabetes
- Herpes Simplex
- Patients who recently had dermal fillers or neurotoxins injected within the treatment area



# Disposable Neutral Pads

- Passive electrode draws the radio signal back to the RF device
- The closer the Neutral Pad is to the treatment site, the less power required from the unit
- Consistency in location of the neutral pad will help maintain more consistent energy delivery
- The Single-Use neutral pad requires direct skin contact
- Make sure there are no wrinkles and that all skin is good contact with the adhesive backing
- Use the correct size NEM pad for the RF application



# Additional RF Safety Guideline Checklist

- ✓ Do not use the RF unit in the presence of flammable anesthetics or other flammable gases, flammable liquids, or flammable objects.
- ✓ Do not use this device in oxygen enriched atmospheres or in the presence of nitrous oxide (N<sub>2</sub>O).
- ✓ Use only non-flammable agents for cleaning.
- ✓ Flammable agents used as solvents for removing adhesives should be allowed to evaporate before powering on the RF unit.





# RF Safety Guidelines

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Surgical Applications



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# RF Safety Guidelines for Surgical Applications

- Do not use needles as monitoring electrodes during electrosurgical procedures. Inadvertent electrosurgical burns may result.
- To reduce the risk of an inadvertent electrosurgical burn at the electrode or probe site, place the electrode and/or probe as far away as possible from the electrosurgical site and/or neutral plate/pad.
- When using an active electrode near a metal (conductive) accessory, ensure the electrode does not come into contact with the metal accessory.
- Use a compatible neutral electrode with a contact quality monitor to ensure that in the event of loss of safe contact between the neutral electrode and client it will be clearly displayed on the generator screen.





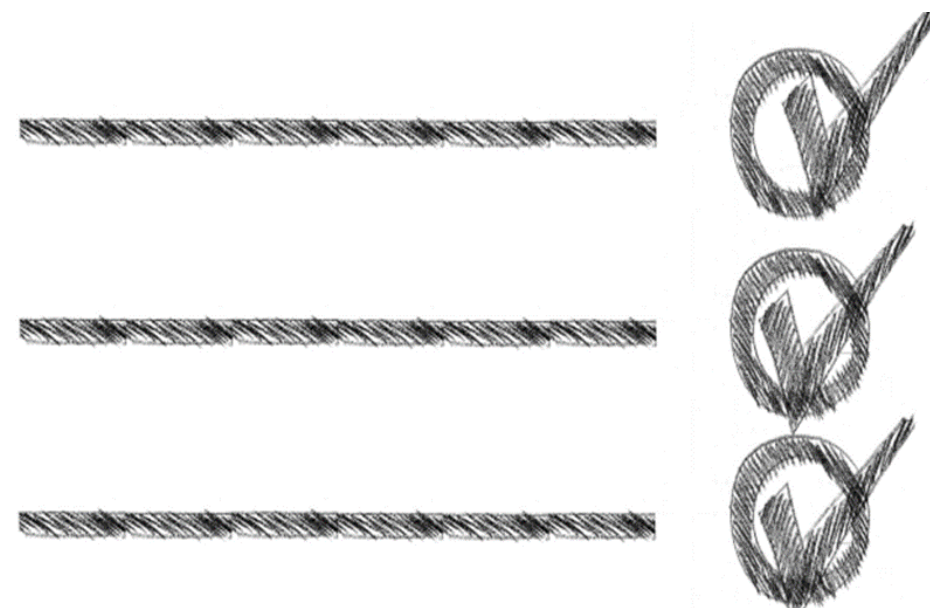
# RF Safety Guidelines for Surgical Applications



- Risks resulting from neuromuscular stimulation can occur, especially with modes producing electrical arcs between active electrode and tissue.
- If higher than normal energy settings are required, examine all cables, temperature sensing handpieces and the neutral plate/pad for damage, and confirm that cables are not wrapped around metal objects or touching the floor. If higher settings are still required, replace the neutral plate/pad and temperature sensing handpieces as need.
- The client should not come into contact with metal parts which are earthed, or which have appreciable capacitance to earth.

# RF Safety Guidelines for Surgical Applications

- Operator to client skin to skin contact should be avoided. Use of insulating gloves is recommended. Client skin-to-skin contact (e.g., between the arms and body of the client) should be avoided (e.g., by insertion of dry gauze).
- When the generator is used simultaneously with physiological monitoring equipment on the same client, the monitoring electrodes should be placed as far as possible from the surgical electrodes. **Needle monitoring electrodes or metal EKG clip electrodes are not recommended.** Monitoring systems incorporating high-frequency current-limiting devices are recommended.
- The cables to the surgical electrodes should be positioned in such a way that contact with the client or other leads is avoided. Temporarily unused active electrodes should be stored segregated from the client.
- Before each use, inspect the accessories, electrode cables and probes for possible physical damage.



# RF Safety Guidelines for Surgical Applications

- Exercise caution when treating subjects with metal implants. Metal implants in the electrical pathway (between the neutral plate/pad and electrode) have the capacity to conduct energy and/or become warm.
- Ensure the neutral pad/plate is placed in closer proximity to the client's treatment area than any ground referenced client contact points such as monitoring electrodes.



# RF Safety Guidelines for Surgical Applications

## Oxygen Hazard

The potential to start a fire in an oxygen rich, closed environment is small but the user should be aware.

## Alcohol Hazard

Alcohol can combust into flames if a spark ignites. Make sure the surgical area is dry before beginning the incision. The surgical site may be rinsed with NSS prior to beginning.

## Smoke Hazard

Due to the use of high frequency surgical RF electrodes, an occupational exposure hazard to smoke plumes and aerosols will occur. A smoke evacuator is highly recommended when using the unit in surgical mode.



# RF Safety Guidelines for Surgical Applications

Risk of exposure of smoke plume and aerosols can occur when operating RF surgical electrodes.

## Smoke Hazard

Due to the use of high frequency surgical RF electrodes, an occupational exposure hazard to smoke plumes and aerosols will occur. A smoke evacuator is highly recommended when using the unit in surgical mode.

## Misconceptions

Not a health hazard  
“Sterile” surgical smoke

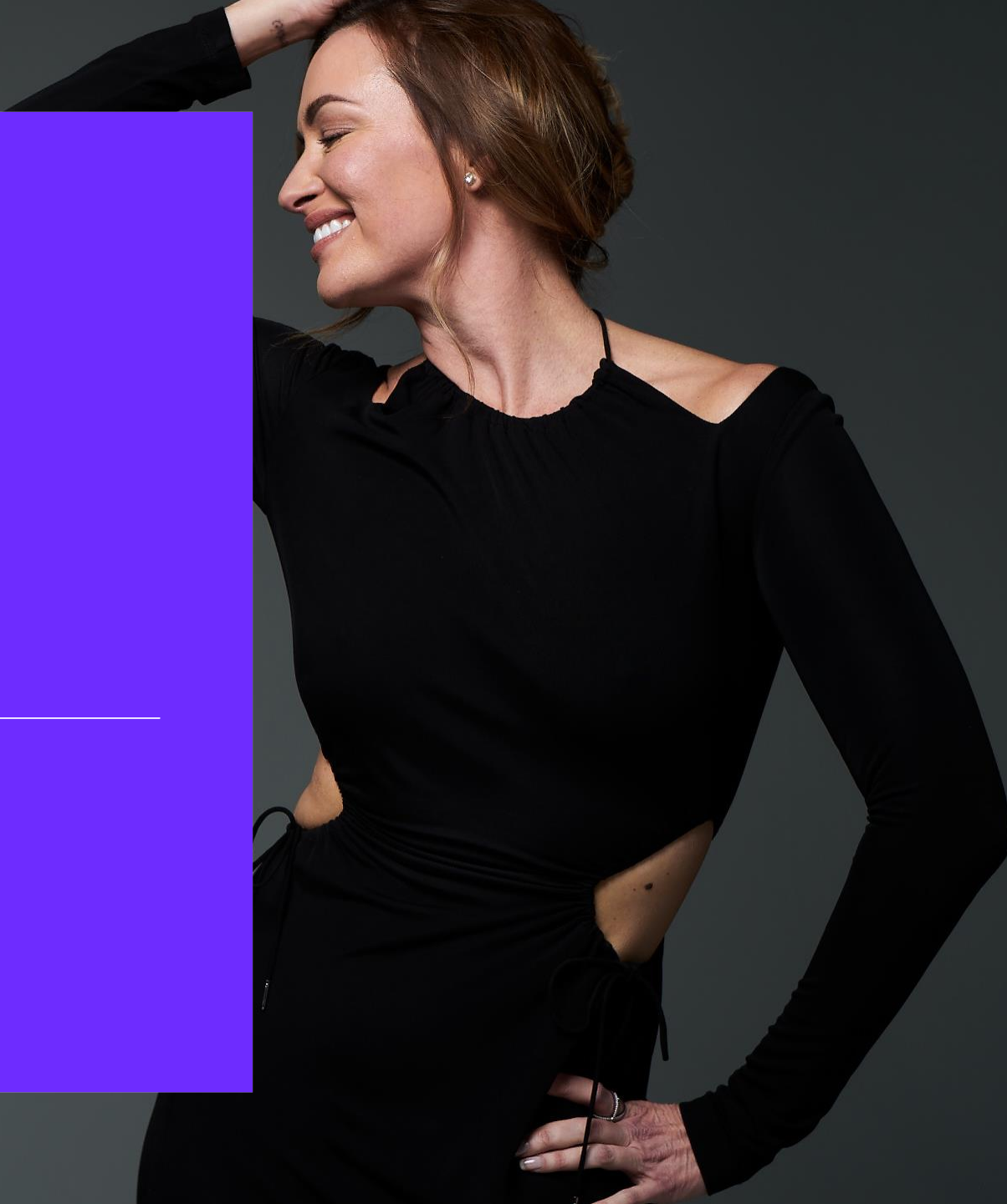
## Reality

Surgical Plume is the same as smoking  
~ 3 cigarettes in 15 minutes



# Questions?

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# Thank You!

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