19 Maximizing Safety with Radiofrequency-Based Devices

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Abstract
Radiofrequency (RF) energy delivered internally or externally has been successfully used to treat rhytids, jowling, skin laxity, telangiectasias, and other age-related skin changes. It has also been used to target subcutaneous tissues for subdermal adipose remodeling and contouring. RF devices create alternating currents to polarize tissue within an electrical path using negatively and positively charged electrodes to generate heat. Safe and consistent use of this technology depends on an understanding of (1) specific characteristics of the patient's skin and soft-tissue anatomy, (2) characteristics of the radiofrequency device, and (3) energy/tissue interactions. In this chapter, we outline the utility of radiofrequency technology, including indications, contraindications, and anatomic danger zones.

Keywords: facial contouring, skin tightening, radiofrequency, microneedle radiofrequency, catheter based radiofrequency

Key Points

- RF is of particular interest as a safe and effective way to decrease skin laxity in facial rejuvenation; either as a primary treatment or to correct recurrent laxity after a facelift or neck lift (▶ **Fig. 19.1**).[1,2,3]
- Thermal devices such as those that are radiofrequency (RF)-based impact the soft tissues at a molecular level by collagen denaturation at 55 to 60°C, leading to subsequent neocollagenesis, ellastogenesis, angiogenesis, and subdermal adipose remodeling over the subsequent 4 to 8 weeks from treatment (**Video 19.1**).[2,4,5]
- RF energy can be delivered using monopolar, bipolar, or multipolar devices. Other variants of RF delivery include fractional, sublative, and combination technologies (laser, light, electromagnetic energy).[4,6,7,8,9]
- RF can be used safely in patients of all skin types, and is most effective in younger patients with mild skin laxity and good skin elasticity.[2,3,10]
- Frequently, RF is used in conjunction with liposuction. RF energy is applied first to tighten the fibroseptal network and induce skin tightening, while the subsequent liposuction decreases the underlying adipose tissue volume.[2,4,5,11]

19.1 Safety Considerations

- Unlike laser energy with selective photothermolysis, RF heating is nonselective. Thus, RF can be applied to any Fitzpatrick skin type without concern for damage to melanocytes or pigmentation changes. However, caution must be used to avoid thermal injury.
- Heating occurs either at the needle tip or along the entirety of the cannula, depending on whether the device is insulated or not.[2,4,9,11]
- Modern safety features include self-cooling RF technology (i.e., cryogen spray), internal/external temperature probes with shutdown features once predetermined target temperatures are reached, external

Fig. 19.1 **(a)** Pre- and **(b)** postoperative results after neck and jowl radiofrequency and liposuction.

near-infrared thermography cameras, and coated cannulas to avoid side and end hits.[2,3,11,12]

- A systematic approach of gradual heating should be applied to sequential areas in order to allow for efficient heating and to avoid burns/full-thickness skin injury.
- In cannula-based devices, heating is applied incrementally from deep to more superficial areas. One should avoid too many passes in one area. No more than 1 to 3 minutes in one particular area is recommended once the target temperature is reached.[2,11]

19.2 Pertinent Anatomy

19.2.1 Treatment Zones (▶ Fig. 19.2):

1. Lower third of the face and neck.
2. Midneck.
3. Lateral neck.
4. Jowls.

19.2.2 Nontreatment Zones (▶ Fig. 19.2):

1. Mid/Upper face.
2. Marrionette lines.
3. Forehead.
4. Perioral/periorbital areas.

19.2.3 Marginal Mandibular Nerve Anatomy[13]:

- The marginal mandibular branch of the facial nerve passes beneath the platysma and depressor anguli oris, supplying muscles of the lower lip and chin (▶ **Fig. 19.3**).
- The marginal mandibular branch of the facial nerve is found superficial to the facial artery and anterior to the facial vein.

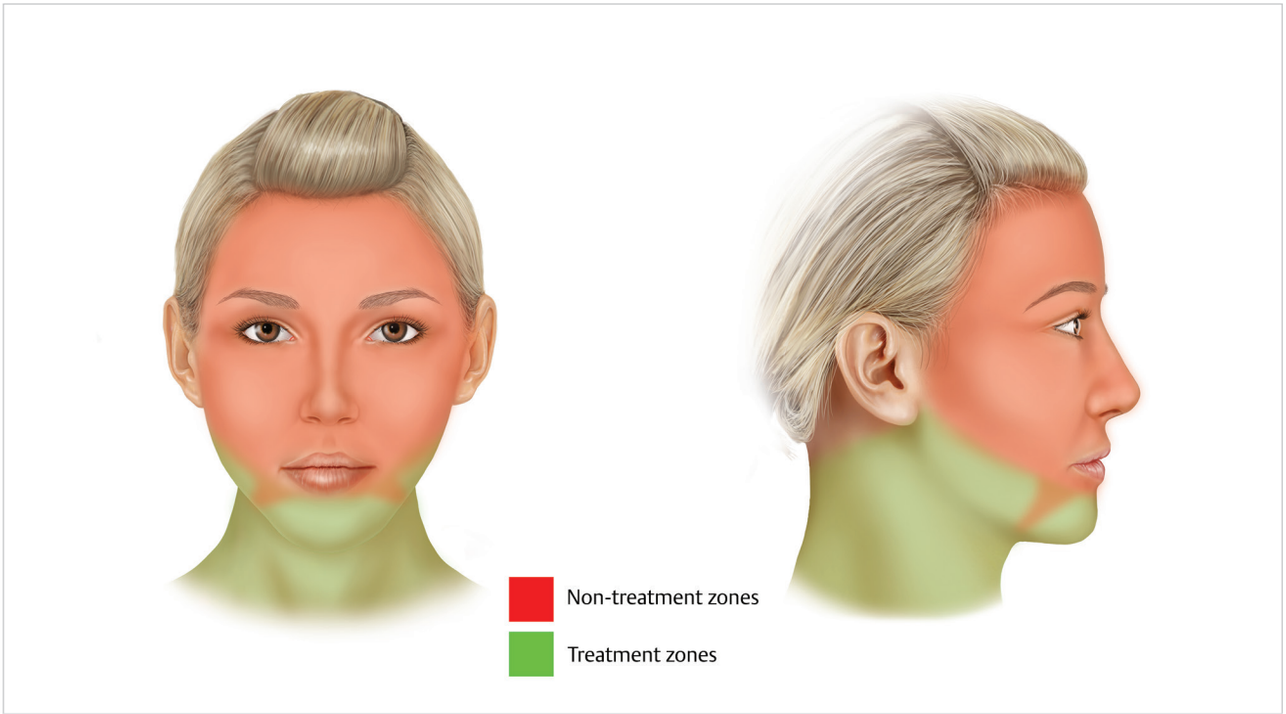

Fig. 19.2 Treatment and nontreatment radiofrequency zones.

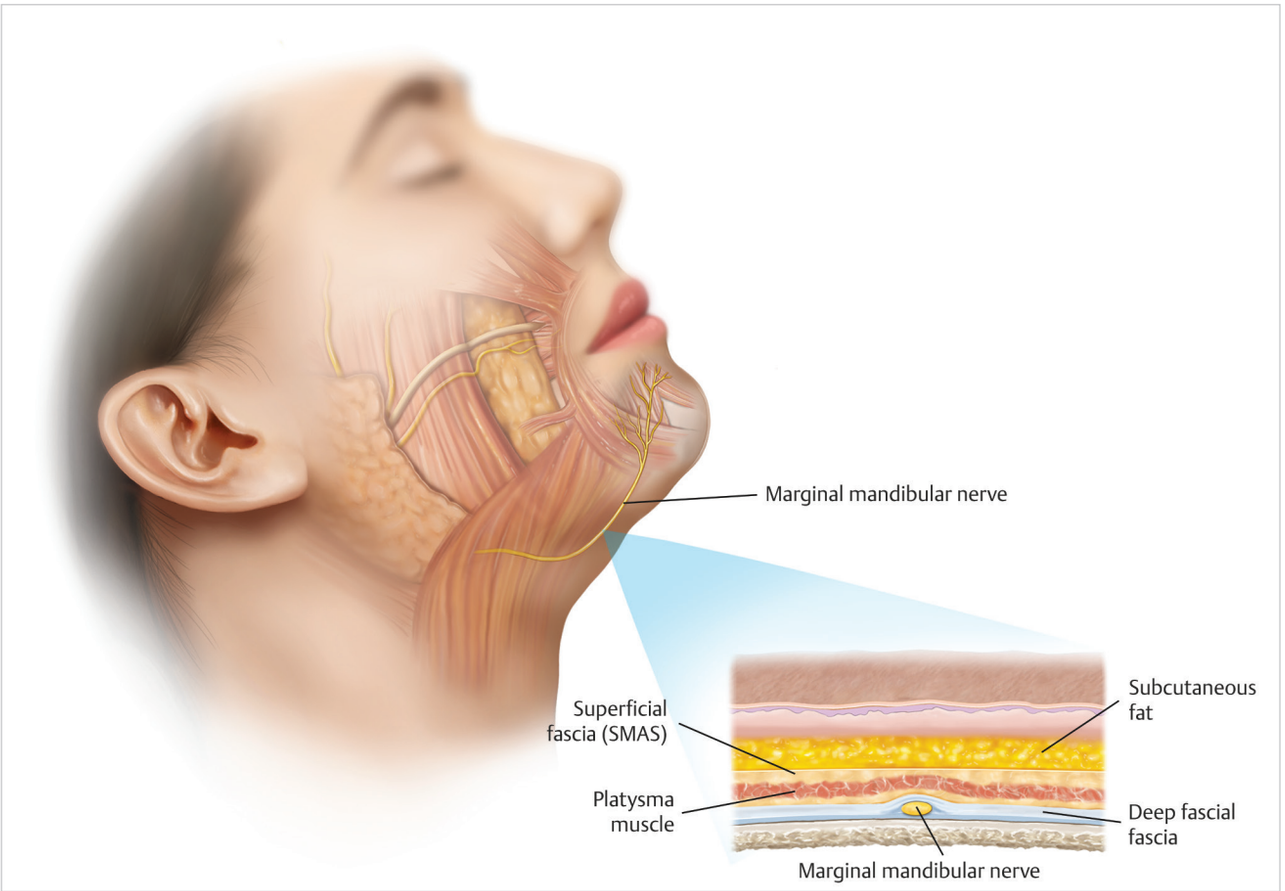

Fig. 19.3 Marginal mandibular nerve anatomy.

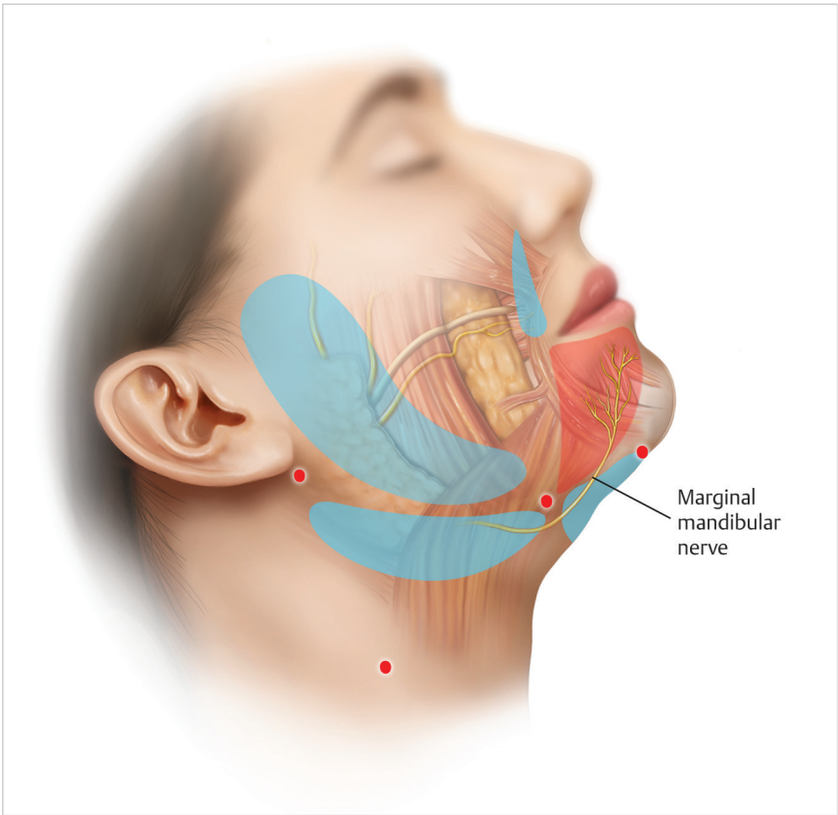

Fig. 19.4 Access ports placement to avoid marginal mandibular and mental nerve injury.

- Entry ports for RF cannulas should be designed to allow for radial motion away from the most superficial area of the marginal mandibular nerve (midmandible, 2 cm posterior to the oral commissure, beneath superficial musculoaponeurotic system [SMAS]) and mental nerve (midmandible below second premolar anterior to SMAS) (▶ **Fig. 19.4**).

19.2.4 Mental Nerve[14]

- A branch of the inferior alveolar nerve (CN V) which provides sensation to the anterior chin and lower lip as well as the intervening gingivae.
- The nerve emerges at the mental foramen in the mandible and travels beneath the depressor anguli oris muscle into three branches (the skin of the chin and the skin and mucous membrane of the lower lip).

19.3 Technical Points

- Most common inadvertent targets include superficial sensory nerves and the marginal mandibular nerve as it approximates areas of jowling and soft-tissue descent at the border of the mandible.[1,3]
- RF probe should remain subcutaneous at all times, and should never be beneath platysma or an SMAS layer.
- A radial motion is used with energy application only on withdrawal.
- Stop energy application 1 cm prior to access point as to not apply energy recurrently when the probe moves proximally.
- Tumescent injection allows for hydrodissection above the platysma/SMAS layer to avoid inadvertent subplatysmal cannula placement.

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