Chapter

BodyTite®: The Science and Art of Radiofrequency Assisted Lipocoagulation (RFAL) in Body Contouring Surgery

Robert Stephen Mulholland

Abstract

BodyTite® is a bipolar, radiofrequency assisted lipocoagulation (RFAL) system and concept that helps the liposuction surgeon better control soft tissue contraction and the contours of the face, neck and body when performing aspiration lipoplasty, or skin tightening alone. There are several different BodyTite® hand pieces that are designed for different clinical procedures and body contouring applications. This chapter outlines the basic science of RFAL, the scientific evidence for contraction and efficacy, as well as, the authors 10-year experience using BodyTite® and RFAL hand pieces to deliver the best possible soft tissue contraction and body contouring.

Keywords: radiofrequency-assisted liposuction/lipocoagulation, RFAL, liposuction, body sculpting, body contouring, BodyTite®, FaceTite®, AccuTite and CelluTite

1. Introduction

Liposuction is the most common cosmetic plastic surgery procedure in the world. The advent of tumescent microcannula suction-assisted lipoplasty (SAL) technique, Power-assisted lipoplasty (PAL), ultrasound-assisted lipoplasty (UAL or Vaser), water-assisted lipoplasty (WAL), laser-assisted lipoplasty (LAL, or SmartLipo) have all been energy assisted innovations to the liposuction technique that have contributed to making liposuction less traumatic, faster, optimize the extraction technique with stem cell preservation (UAL) or offer moderate dermal contraction (LAL) [1–6]. Despite these advances in the basic liposuction technique, one of the major challenges facing liposuction surgeons is optimizing and ensuring soft tissue contraction and body contouring outcomes after removal of adipose tissue [7–11]. Worsening of skin laxity and suboptimal soft tissue contraction following adipose aspiration is common [1].

The Introduction of BodyTite® Radiofrequency Assisted Liposuction 10 years ago and the evolution of the various RFAL applicators and technology since that time has led to an era of optimal control of soft tissue contraction and more consistency in quality body contouring results [12–14]. This chapter outlines the peer reviewed articles and basic science of BodyTite® and reviews the authors use of RFAL in over 1000 cases in his body contouring and facial rejuvenation practice.

2. Basic science of BodyTite® and RFAL

The BodyTite® device is comprised of a workstation, or platform, which houses the RF Generator, software and circuit boards of the system. Into this workstation attach the various clinic hand pieces (**Figure 1**). The hand pieces come in different sizes and configurations and are designed for specific clinical procedures and anatomical locations.

Each BodyTite® hand piece is in a bipolar configuration, where the internal electrode is a silicon coated cannula that is RF emitting in its distal uncoated region and has a sophisticated bullet shaped tip to aid is soft tissue dissection and movement, while minimizing the risk of end dermal hits and thermal injury.

The external electrode, which is attached to the same hand piece, slides along the surface of the skin in tandem with the internal electrode (**Figure 2**).

The internal electrode emits positively charged RF current, which flows back and forth from the positively charged internal electrode to the negatively charged external electrode. The RF is strongly ablative and coagulative within 1–2 cm of the internal electrode and dissipates at is flows and diffuses up to the external electrode. Soft tissue within 1–2 cm of the internal electrode will undergo a necrotic, ablative tissue thermal effect, while the dermis will experience a sub-necrotic, non- ablative dermal, thermal stimulation.

The Radiofrequency energy within 1–2 cm of the internal electrode provides a coagulative, ablative issue on local tissue, adipose, vascular and the fibroseptal network (FSN). As RF flows up, ever more diffusely, to the external electrode moving in parallel and in tandem with the internal electrode, RF will be more diffuse and is flowing to a much broader, bigger surface area electrode and the thermal effect on the dermal structures will be non-ablative heating (**Figure 3**).

Figure 1.
The BodyTite® RFAL workstation. The various hand pieces in the BodyTite® RFAL family plug into the workstation.

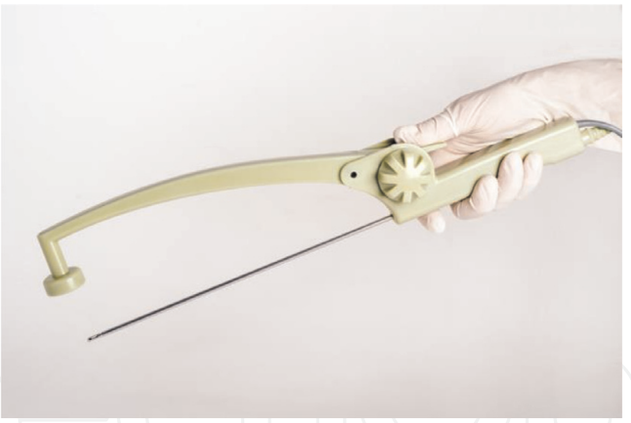

Figure 2.
The BodyTite® bipolar RFAL hand piece.

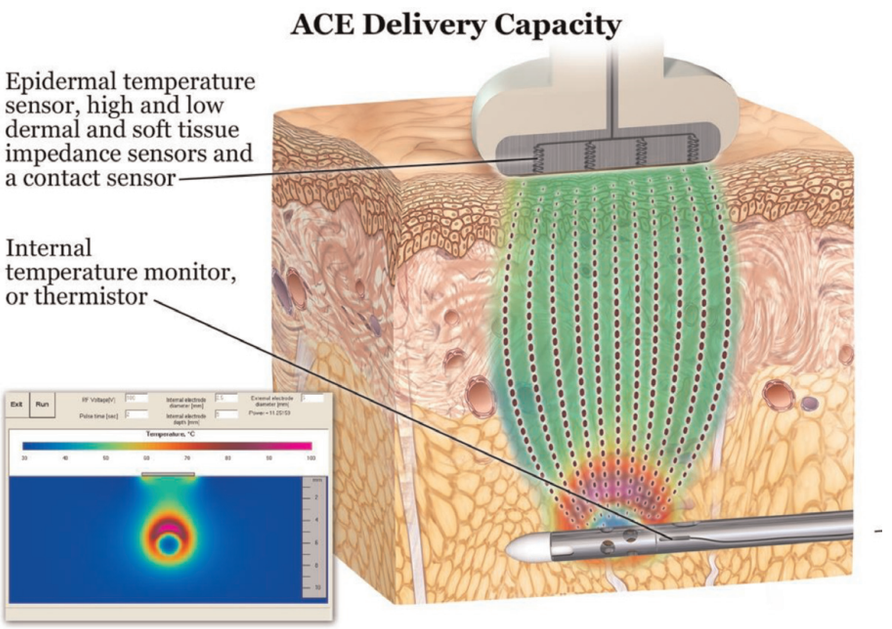

Figure 3.
The RF energy flows from the internal electrode, where it is ablative in nature, to the external electrode, where the RF has a gentle non-ablative thermal effect on the dermis.

The Soft tissue tightening concept of BodyTite® is to provide and 3-dimensional contraction of the soft tissue through internal RF stimulation and contraction of the Fibroseptal network, together with dermal enhancement through non-ablative thermal stimulation and neo-collagenases [15].

2.1 Safety features of the BodyTite® hand pieces

The Following features have been built into the hardware and software of the BodyTite® to optimize soft tissue contraction and minimize the risk of a thermal injury.

2.1.1 The silastic coating and cap

The proximal internal electrode is silicone coated along its length to minimize the risk of a thermal injury to the access port and soft tissue that is not in direct proximity to the tip. There is a small, distal section of the internal electrode that is not silicon coated and this portion emits the positive charged radiofrequency

energy. The distal aspect of the internal electrode has a silastic, bullet shaped cap, which facilitates dissection through the adipose tissue and minimizes the risk of an end dermal hit, or thermal injury to the underside of the dermis or deeper, delicate soft tissue structures.

2.1.2 Thermal containment

The RF energy is high frequency electrical current that travels in a wave form and oscillates between the internal and external electrode at a frequency of 1 million cycles per second. The RF energy oscillates molecular structures in its path 1 million time per second, generating intermolecular kinetic energy and heat. The heat can be necrotic and ablative in nature (near the tip) or sub necrotic, non-ablative tissue heating (the external electrode). The RF flows from the small, internal electrode with a smaller, more focused tip and high power density to the larger, lower power density external electrode providing "thermal containment", or heating energy between the two electrodes, with very little heating below the internal electrode, which is a safety feature when performing RFAL around delicate structures like the face and neck where there is a the Facial nerve that is under the investing fascia of the facial muscles and is sensitive to thermal stimulation if there were significant heat flowing below the internal electrode.

2.1.3 Automate feedback control loops

There are a number of high-tech sensors built into the BodyTite® hand pieces that communicate with the software algorithm on the workstation (**Figure 4**).

Figure 4.
The GUI screen o the BodyTite® RFAL workstation. On the left hand side, he external (skin) electrode and internal electrode (adipose) cut off temperatures are set by the physician. Increments of 120 s of RF energy are dispended and when the 120 s are up, double clicking on the foot pedal gives another 120 s. On the right-hand side are the real time temperatures of the external skin and internal fat temperatures as measured by the external electrode and internal electrode thermistors. As the user gets within 2°C of the cut off temperature, the audible beep that is emitted when RF energy is on, increases in tempo and when the cut off temperature is reached, either internal or external, the and audible will sound that is characteristic for the external and one for the internal cut-off and the RF energy delivered is terminated to the hand piece and tissue heating stops. When the external and internal temperature is 0.1°C below the cut-off RF energy flow begins again. The automated feedback loop allows heating of the adipose and skin to occur together or independently and not exceed the pre-set amounts.

Contact *Sensors:* within the external electrode there is a contact sensor and if there is loss of contact, the RF flow is cut-off, minimizing the risk of arch burns or excessive flow from the internal electrode. *External and Internal Thermistors:* there are thermistors in the external electrode and near the tip of the internal electrode (US models only) that continuously measure the local temperature every millisecond. The Thermistors permit the physician to enter the desired cut off temperature of the skin and internal cut off temperature of the adipose tissue and the software algorithm within the workstation will cut off the RF energy when the desired external or internal cut-off temperature is achieved. *Temperature Display and Audible Alerts*: the device interface displays the internal and external temperatures at all times and has an audible alert when the skin, or internal temperature is within 2°C of the cut-off and, then another distinct audible for the both the skin and internal temperature when the desired cut-off temperature has been reached. When the cut off temperature has been achieved the RF will be turn off and on again around that temperature, allowing the physician to sustain the desired thermal endpoint for a prolonged period of time, if desired.

The treatment time and amount of energy delivered in seconds and KJ is measured.

Impedance Cut offs: impedance is the resistance to RF flow through tissue. As the tissue temperature increases, impedance will decrease and if the impedance drop is too great, then the RF energy will be cut off. Conversely, if the resistance to flow is too great (usual cause is divergent electrodes, where the internal is going one way and the external another), or there is solid tissue between the electrodes, or very fibrous tissue between the two electrodes, the impedance will rise and the RF energy is cut off.

Temperature Surge Protection (TSP): the BodyTite® applicator and workstation will continuously measure the *"rate of rise of temperature"* and will deliver full RF power if the tissue is being heated at less than, or equal to 20°C/cm^3/s, but will decrease the RF energy if the rate of rise of temperature is between 20 and 35°C/cm^3/s until the rate of rise of temperature is again 20C/cm^3/s and will turn off the RF energy completely (necessitating stepping on the foot pedal again to start) if the rate of rise exceeds 35°C/cm^3/s, a process is called TSP, or Temperature Surge Protection, or TSP. This rate of rise of temperature algorithm is empirical and based upon the observations that excellent FSN shortening and soft tissue contraction can be achieved less than 20°, which the risk of thermal injury increases as more tissue is heated/cm^3/s. The physician does not select an energy setting or desired power when selecting treatment parameters, as the device will automatically give enough RF power to maintain a heating profile of 20°C/cm^3/s. The US version of the BodyTite® has TSP, while the International version does not and uses high and low internal impedance cut offs rather than TSP. The international version allows the physician to enter the desired power (up to 70 W for the larger BodyTite® hand pieces and 25 W for the smaller FaceTite® applicators and aspirates while it coagulates. as the internal electrode is a hollow cannula and the hand piece can hook up to wall suction. The US version is non-aspirating and all suction is performed after or before the RFAL a non-thermal SAL or PAL cannula.

2.2 Evidence for RFAL thermal contraction

There are a number of well-designed studies that have confirmed significant soft tissue contraction following BodyTite® and RFAL. Kreindel and Mulholland were able to show the vertical, horizontal and oblique fibers of FSN (**Figure 5**) as the major vehicle for significant three-dimensional soft tissue contraction at the time of surgery [15]. Further, this paper showed that 69° was the optimal temperature for thermal contraction and shortening of the FSN network. Duncan and others [16],

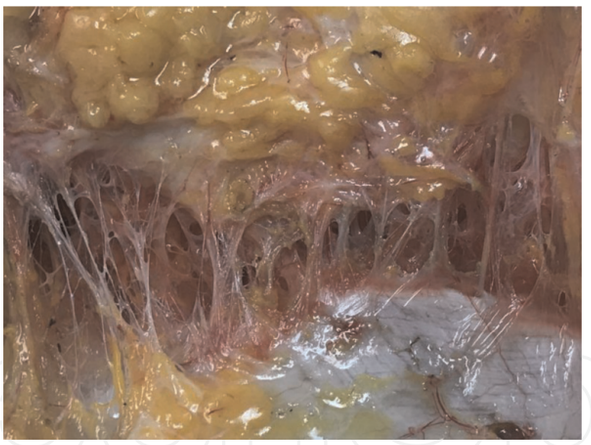

Figure 5.
The FSN are shown above connecting the anterior rectus sheet below to the overlying abdominal adipose tissue. The vertical, horizontal and oblique Fibroseptal bands will shorten and contract when the RFAL thermal temperature and stimulation reaches 69°C pulling the overlying soft tissue envelope in tighter association with the underlying muscle and delivering soft tissue contraction.

were able to confirm upwards of 25% soft tissue area contraction after BodyTite® and RFAL at 6 months, which increased to 34% at 12 months. There have been numerous clinical papers outlining the soft tissue contraction advantages of the RFAL applicators in the face, neck, arms, inner thighs and body [17–22].

3. Clinical approach and basic parameters

The basic RFAL approach of the author has been to deploy BodyTite® applicators just before aspiration to ensure optimal soft tissue contraction, liquefy the adipose tissue for more gentle aspiration forces and coagulate the small venules and arterioles to lessen post aspiration extravasation and ecchymosis. Some physicians choose to aspirate first and perform the RFAL after debulking and they have reported good results with this technique, but theoretically aspirating first may compromise and traumatize some of the FSN, perhaps limiting the amount of contraction that could occur and would injure the small vessels before thermal coagulation increasing the risk of bruising.

The BodyTite® applicators come with a dial on the hand piece that can control the distance between the internal and external electrodes, facilitating delivering thermal coagulation and different depths and levels. In general, Level 6, 5, 4, 3, 2 and 1 correspond to 6, 5, 4, 3, 2 and 1 cm inter-electrode distance and, remember, the effective coagulation is within 1–2 cm of the tip of the internal electrode (**Figure 6**).

3.1 The basic principles of RFAL treatment are

1. Shorten the vertical, oblique and horizontal FSN for optimal contraction.

2. **The FSN contracts** optimally at 69°C.

3. **The area of thermal coagulation** radiates within 1–2 cm of the uncoated tip of the internal electrode/cannula.

4. **Multiple, vertical sequential** levels of the adipose tissue will be needed to be treated to ensure optimal recruitment and coagulation of the FSN.

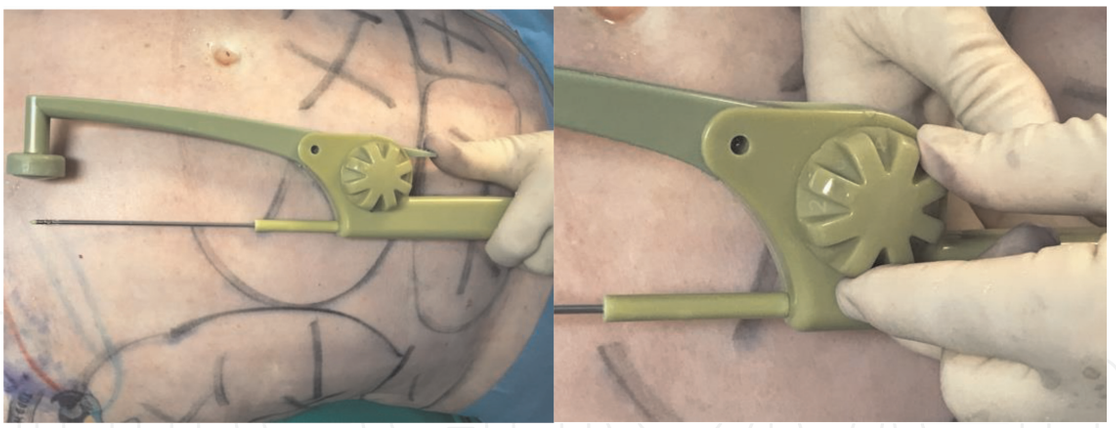

Figure 6.
The various BodyTite® applicators are bipolar RF electrodes, with the internal, positively charged electrode being inserted into the adipose tissue and the external, negatively charged electrode sliding along the surface of the skin in tandem with the internal. RF flows from the internal, uncoated electrode with the RF energy is ablative close to the electrode, up through the adipose to the dermis, skin and large diameter electrode where the RF is then more diffuse and non-ablative in nature. The physician can control the distance between the electrodes by setting the inter-electrode distance on the proximal end of the hand piece. Each setting, 1–6 on the dial corresponds approximately to the number of centimeters between the electrodes.

5. **The FSN thermal stimulation** is planned every 2 cm, so for thinner lipodystrophic zones, only two levels of sequential thermal coagulation may be required, while for larger adipose zones, three or more levels are needed.

6. **Pinch test:** prior to the Tumescent infiltration, pinch the thickness of the zone of fat you are treating. Divide this distance in half to determine the thickness of the adipose tissue. Calculate the number of 2 cm increments will fit into the final thickness of the flap and that will determine how many vertical levels will be treated. For example, a zone of fat to be treated measures 12 cm when pinched, means that the flap is 6 cm thick. Starting from the bottom, 2 cm intervals factors 3 time into 6 cm. So, the first lipocoagulation pass will be a level 6, followed by levels 4 and then a pass at level 2 (the effective coagulation zone is 2 cm). The author does not find the need to treat any closer to the skin than level 2. If the pinch test was 10 cm = a 5 cm flap = level 5 and level 3 would be deployed.

7. **Tumescent infiltration:** super wet is preferred over Wet, or tense tumescent and remember, RF travels most efficiently in a salinized environment. The author uses "double strength" Klein solution to salinate the adipose tissue, as the majority of BodyTite® RFAL is performed under local anesthesia and the thermal stimulation is more uncomfortable than SAL, UAL or PAL.

8. **Stamping and vertical sequential thermal treatment:** the author starts at the deepest calculated depth and advances from the port the most distal aspect of the zone. The hand piece is withdrawn the width of the external electrode and the thermal energy is applied until for 1–2 s or an audible pop (International Physician system) or until the audible internal cut off of 69° sounds. The foot is taken off the pedal and the hand piece is then withdrawn the distance of the external hand piece width and the process repeated. This is called the stamping technique (stationary until the endpoint is released) (**Figure 7**).

Other physicians will withdraw very, very slowly, allowing the temperate to rise to therapeutic cut off while withdrawing. GOAL of this step is to ensure as much of

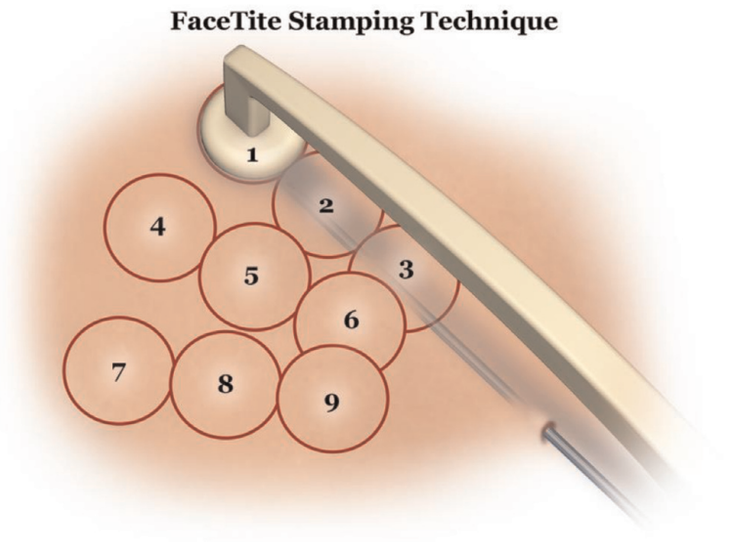

Figure 7.
The stamping technique. Stay in each spot until the internal thermal cut-off of 69–70 is reached, then move to the next spot.

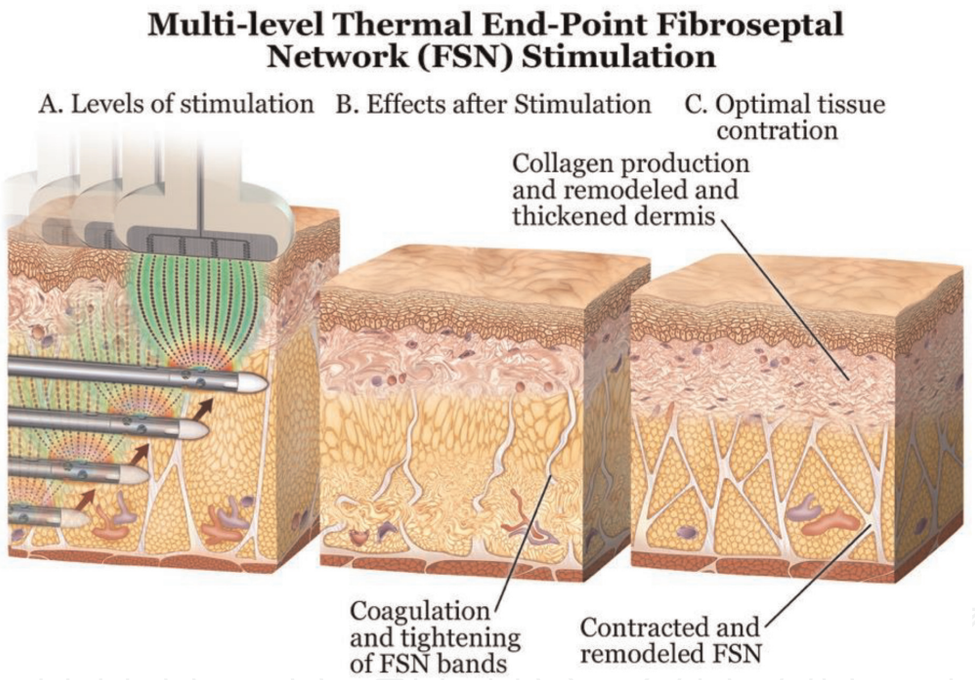

Figure 8.
Vertical sequential thermal stimulation to 69–70° cut-off is achieved, which is the temperature that optimizes the FSN contraction and remodeling, resulting in the 35% or greater skin and soft tissue contraction.

the FSN experiences 69°C for optimal contraction. This process is performed at each vertical levels determined by the "skin pinch" and 2 cm formula. Multiple, sequential vertical FSN thermal stimulation and contraction is then achieved, optimizing the 3D soft tissue skin and adipose contraction and body contouring results (**Figure 8**).

9. **Avoiding a peri-port burn: when you get close to the port, ensure you do** not end up at the same spot each time to avoid a peri-port burn. Try to zigzag through the adipose tissue as you advance and withdraw always to a different spot around the port (**Figure 9**).

Once I have stamped retrograde on the way back, or using a slow moving technique, I will keep my foot on the pedal and perform several back and forth

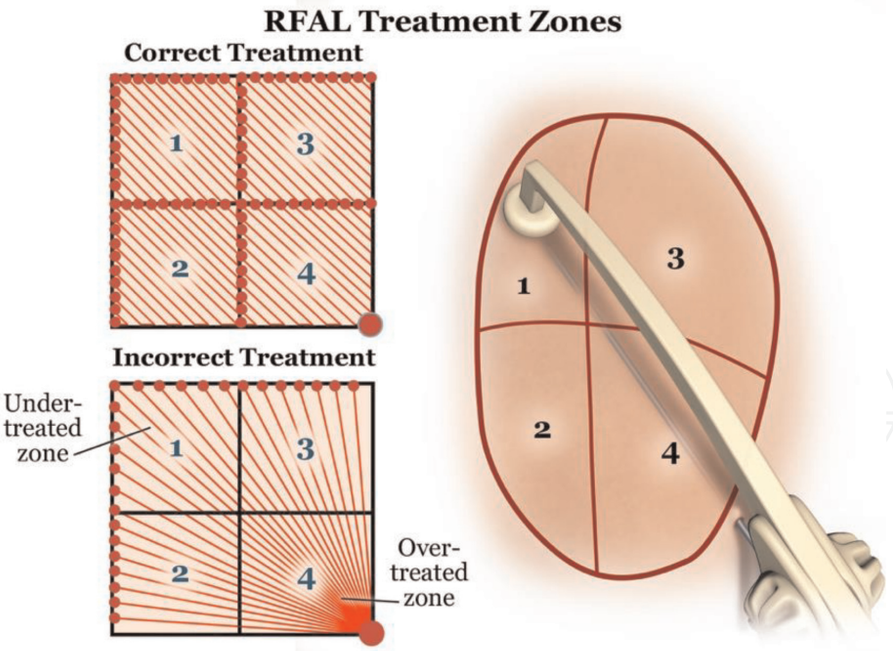

Figure 9.
Zig zag the applicator through the adipose tissue to avoid coming the same peri-port location each time, which will help avoid a peri-port thermal injury.

passes, slow moving technique, at that depth to ensure optimal thermal coverage of the FSN, as well as more complete lipocoagulation and liquification (easier aspiration, perhaps less trauma to the FSN, edema and pain) and coagulation of small venules and arterioles prior to aspiration (less ecchymosis). Again, it is important to zigzag your back stroke to avoid a peri-port burn (**Figure 9**).

10. When you have covered the 8 × 15 cm zone at one depth, stamping and slow moving, withdraw the internal electrode/cannula from the port and set the dial, 2 cm more superficial and repeat the stamping or slow withdrawing technique at the next, more superficial level. In the BodyTite® devices in the USA, the internal temperature before you move up to the next most superficial level must be 69 or 70° to get optimal FSN contraction (internal cut offs will not go higher the 70°). International BodyTite® users will find the external temperature will rise 4–5°C at each successive, more superficial level and there is no internal thermal cut-off control.

11. The skin temperature will continue to rise at each successive more superficial level until you approach the end point of 38–40°C. Both International and USA BodyTite® users would set their external skin cut off temperatures to 38–40°. *REMEMBER:* it is the FSN shortening that leads to the optimal soft tissue contraction, rather than non-ablative dermal heating. However, 38–40° epidermal, external cut off will result in more dermal collagen, elastin and ground substances, which will contribute to perhap. 15% over the overall tightening result, while FSN tightening accounts for 85% of the contraction we see with RFAL.

12. **Final aspiration and contouring:** when all levels have been treated and the adipose tissue has been heated to 69–70° and the skin to 38–40°, final aspiration is performed. International BodyTite® users have an aspirating internal electrode/cannula and this allows the physician to heat, coagulate and aspirate synchronously, so when they have completed the vertical sequential thermal coagulation, approximately 30% of the planned aspiration has

already been performed. It is more efficient to switch to dedicated aspirating cannulas or PAL systems when the thermal coagulation is done, than continue to aspirate with the RFAL cannula. United States BodyTite® users, have a non-aspirating cannula (FDA requirement) and suction begins once the vertical sequential thermal stimulation has been completed, again using dedicated aspiration cannula's or PAL systems.

13. **RFAL first or last?** From a purest perspective, there are advantages to performing BodyTite® RFAL first, followed by completion aspiration. However, some physician, particularly with larger BMI patients or large zones, perform the aspiration first, followed by BodyTite® thermal coagulation of the reduced, near final contour second (less tissue to heat) and perhaps refinement aspiration last. Although this approach is much faster, some of the theoretical disadvantages are: (i) more trauma to the FSN before thermal coagulation and potentially less contraction. (ii) traumatic aspiration disruption of small vessels may result in more ecchymosis, edema pain, hemosiderosis and hyperpigmentation.

3.2 Patient selection

Like any liposuction or Body Shaping procedure, RFAL patients need have realistic expectations, no uncontrolled medical conditions and appropriate skin tone and focal or multifocal lipodystrophy concerns. The BodyTite® family of applicators allow physicians to selection the right-hand piece for the job. International Physicians have a slightly different array of hand pieces and thermal controls than American physicians (FDA requirements) but both parameters are outlined below. In general, BodyTite® RFAL treatment can deliver up 35% area contraction over 12 months and, as such, does allow the physician to extend the indications for liposuction to patients with more skin laxity than they might have in the past. Those older patients, or those with larger BMI's, weight loss and weight gain, multiple parity may be BodyTite® candidates. The optimal RFAL soft tissue contraction means that physicians may be able to offer more minimal excisions: mini tummy tucks, axillary arm-lift, anterior inner thigh lifts and mini facelift in combination with BodyTite® RFAL treatment.

3.3 Port selection

Once you have selected a good BodyTite® candidate, then the appropriate port is selected to access the targeted lipocoagulation areas. Both RFAL BodyTite® and final aspiration contouring will be performed through the same port. Generally, this author prefers a single, well concealed port. The authors most favored zonal access ports are outlined in **Figure 10**.

3.4 RFAL thermal approach

Vertical sequential multi-level thermal coagulation, both stamping and/or slow moving to the deep (USA) and skin (International and USA) end points. Aspiration generally follows the heating (**Figure 8**).

3.5 Parameters

USA BodyTite® physicians: cut off of 69–70°C internal and 38–40°C external and 120 second treatment cycles. In the USA, the energy in watts is not entered as the

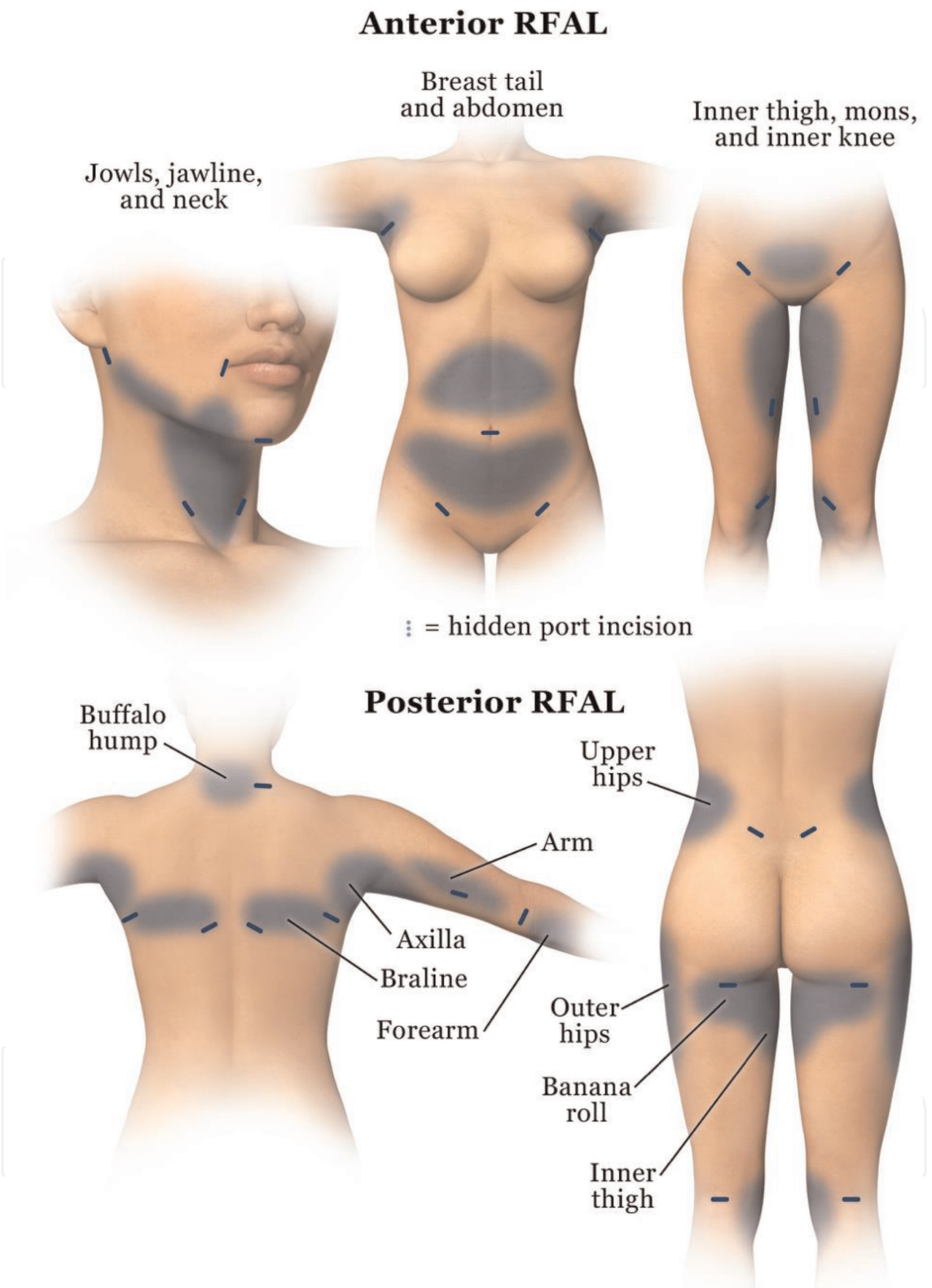

Figure 10.
Some of the standard BodyTite RFAL and aspiration ports.

device will deliver the precise amount of energy to heat the adipose at 20°C/cm^3/s, while, for *International BodyTite®* users, the energy in watts will need to be entered and this will depend upon the hand piece selected and thickness of the flap. General energy settings for the international physicians are 50–60 W for the 3.7 mm × 25 cm and 17 cm large hand pieces, and 40–50 W for the 2.4 mm × 17 cm NeckTite® hand piece. For the FaceTite® 1.2 mm × 10 cm hand piece, 25 W is used. The New AccuTite® 0.9 mm × 8 cm applicator only requires 10–20 W.

3.6 Thermal end points

The thermal endpoints are thermal, 69–70° internal (USA) and 38–40° external cut off (USA and International). The final contour endpoints remain the art of the physician and are the aspiration endpoints.

3.7 Postoperative care

Postoperative BodyTite® care is similar to non-thermal liposuction and the author favors 6 weeks of compression garmenting. The first week is with silicone coated foam compression and the next 5 weeks the garment alone. For Abdominal RFAL BodyTite® cases, a small #7 JP drain is used, as seromas are much more common than with SAL, with an incidence approaching 8–10%. Presumably post RFAL seroma are more common resulting from temporary thermal damage of the lymphatics that takes some time to normalize. The drain is removed when there are three consecutive days with less than 20 cc of drainage each day. The first 3 weeks of garmenting are 22 h per day, which is reduced to 12 h a day (day or night time) for the next 3 weeks. Full ambulation is encouraged immediately, but return to low impact activities, such as an elliptical, stair climber, exercise bike at the end of 3 weeks and high impact exercise, running, spinning, etc. at the end of 6 weeks.

Noninvasive bulk heating devices, to achieve even better skin tightening can be deployed when the skin is less sensitive at 8–12 weeks. Shock wave devices can be used on any areas of lumps and areas of firmness.

BodyTite® leaves the skin very stiff, indurated and firmer for longer than non-thermal SAL/PAL or UAL and there is strong sense of tightness and contraction on the part of the patient for the first 6–9 months, which is the contraction process. At 3–6 months, for any areas of slight contour excess, noninvasive, localized fat destruction technologies, like SculpSure®, BodyFx®, EMSculpt®, CoolSculpting® and Ultrashape®, can be used to try to improve the contour non-surgically.

4. BodyTite®

Internationally there are 3 BodyTite® hand piece options, a 3.7 mm diameter × 25 cm or 17 cm long and a 2.4 mm × 17 cm long, also called the NeckTite®.

Figure 11.
The RFAL family of applicators, starting with the FaceTite® on the left, the BodyTite®/NeckTite® 2.4 mm, the CelluTite and the larger BodyTite® 3.7 mm × 25 cm (not all are available in the USA, but are internationally).

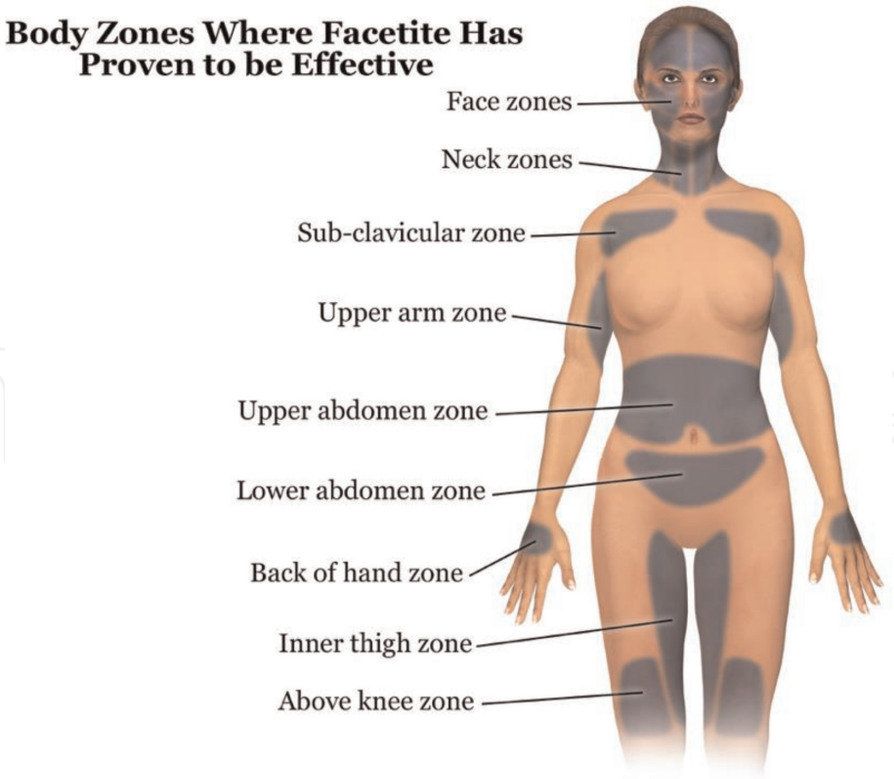

Figure 12.
Common areas where RFAL BodyTite®, FaceTite® and AccuTite® treatments can be effective.

The BodyTite® USA workstation comes in 20 W and 40 W configurations, the 40 W being more powerful and faster to endpoints and is called the BodyTite PRO (**Figure 11**). Both versions of the USA BodyTite® workstations automatically give as much power in watts as the treatment and hand piece needs to achieve the thermal velocity during the treatment of 20°C/cm^2/s and when this thermal velocity is exceeded (20–25°C/cm^2/s) will adjust down the energy until it is under 20°C/cm^3/s and if the rate of rise is >35°C/cm^2/s will shut off the energy flow and the foot pedal must be tapped again to being. The only BodyTite® hand piece currently available in the USA is the 2.4 mm × 17 cm hand piece.

Following the protocols and parameters outlined above, excellent results using RFAL thermal coagulation can be achieved. The areas that may benefit from BodyTite® and RFAL are outline in **Figures 12**, **13**.

5. NeckTite (BodyTite 2.4 mm)

The NeckTite® is available internationally and is 2.4 mm × 17 cm and was originally designed for large necks, but has become the smaller BodyTite hand piece for smaller adipose zones in the non USA markets, while the 3.7 mm diameter hand piece is used for the larger body zones. With the introduction of the FaceTite Internationally and in the USA, the FaceTite(R) has become the RFAL applicator used most commonly for jawline, necks and very small body zones.

For International physicians, the external electrode of the 2.4 mm × 17 cm NeckTite® hand piece is much smaller in diameter than the BodyTite® 3.7 mm external electrode and, as such, has a much higher power density, is more efficient and heats tissue much more quickly and with less energy.

Using the protocol and parameters outlined above, excellent small zone Body contouring results can be achieved with the 2.4 mm × 17 cm hand piece and is most commonly used on the inner thighs, bra line, arms and smaller abdominal convexities (**Figure 12**).

Figure 13.
BodyTite® before and after result at 12 months. Top panel RFAL was performed on the inner and outer tight of a 45-year-old and the middle and bottom panel BodyTite® was performed on the abdomen and hips in 68-year-old patient.

6. FaceTite

The FaceTite® is a very small RFAL applicator, designed for the neck, jawline, face and very small body contouring areas and is great for small secondary liposuction enhancements where fibrofatty tissue, which is like cement, can be anticipated (**Figures 14**, **15**).

In both the USA and Internationally, the FaceTite® hand piece is 1.2 mm in diameter × 10 cm long and is a solid, non-aspirating electrode (even internationally). The distance between the internal and external electrode is controlled by pinching the electrodes together to create the desired interelectrode distance, rather than a fixed dial, prior to entering the subcutaneous fat. Again, super-wet tumescent fluid is infiltrated prior to treatment (**Figure 15**).

Using the protocols and parameters listed below, excellent results can be achieved tightening along the jawline and neck and small body contouring areas. The treatment of the jawline, submentum and neck can be performed using a three port approach, with a single submental port accessing the submentum and neck for

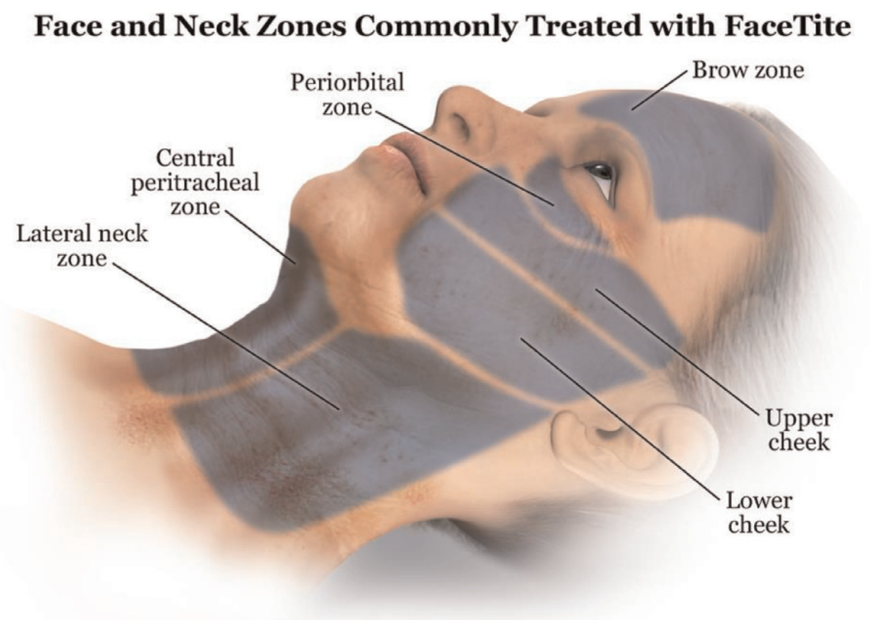

Figure 14.
Areas of the face and neck that can be treated with the FaceTite® and AccuTite®.

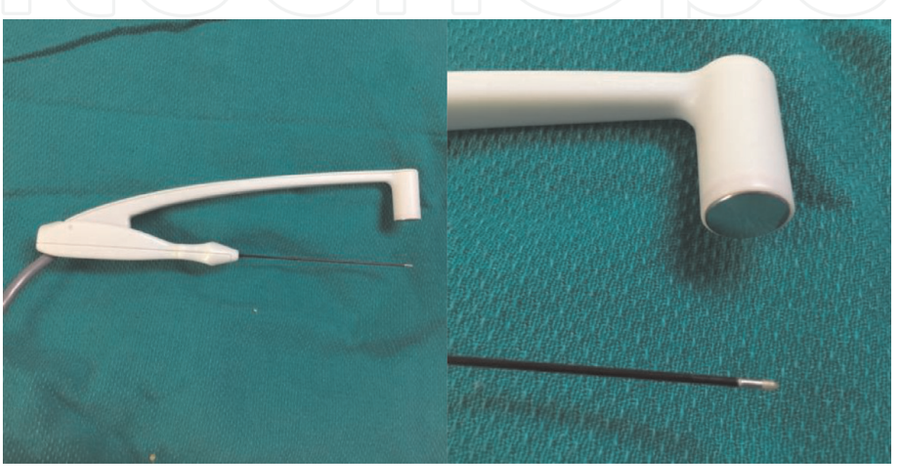

Figure 15.
The FaceTite® applicator.

RFAL and aspiration. Two more lateral ports are used to thermocoagulate and tighten each jowls and jawline. These Jawline and jowl ports can be either at the inferior border of the mandible at the lateral aspects of the submental crease on either side, or, through a sub-lobular port (**Figure 16**).

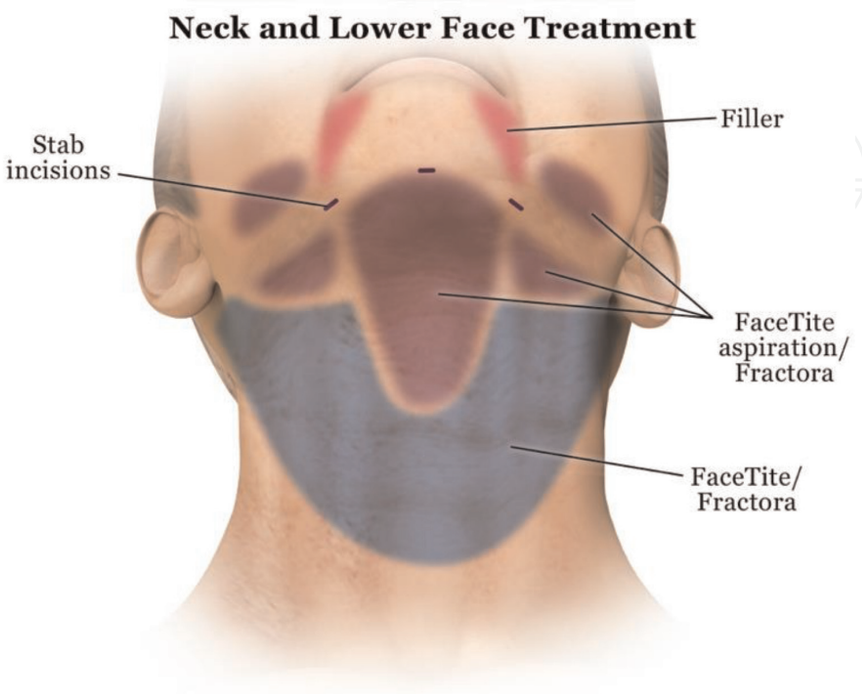

Figure 16.
The FaceTite® RFAL approach to the submentum, neck and jawline.

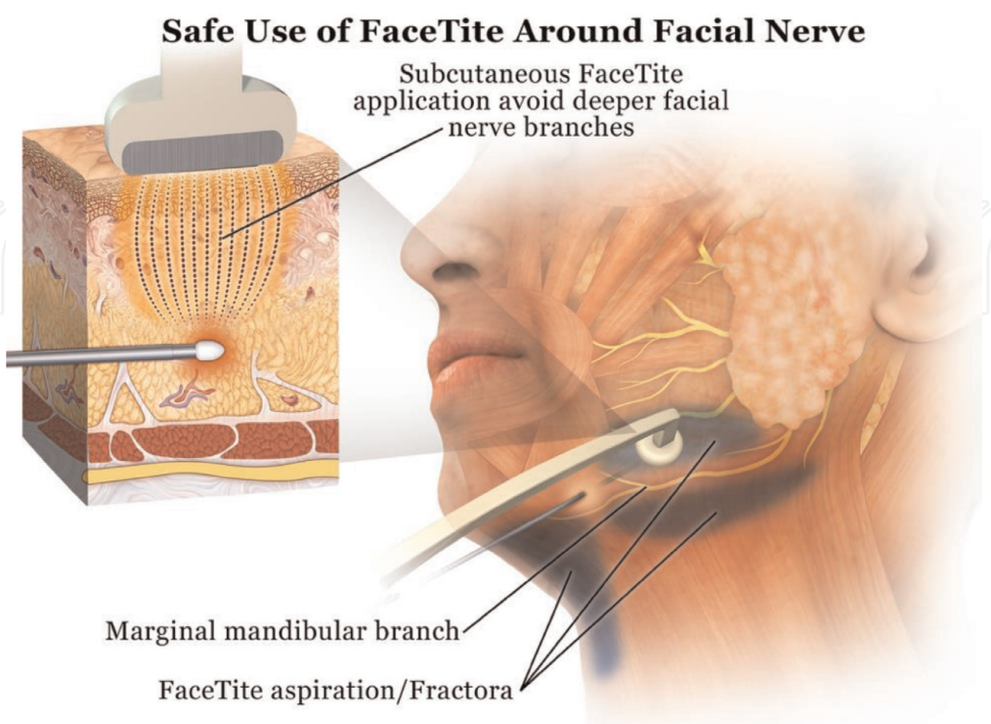

Figure 17.
Keep the internal electrode of the FaceTite® above the SMAS and platysma, working in the very superficial fat, to protect injury to the marginal mandibular branch of the facial nerve.

When working over the jawline, the FaceTite® physician must ensure that the internal electrode is above the SMAS and platysma, in the subcutaneous space to minimize the risk to the facial nerve. Because the RF flow is from the internal

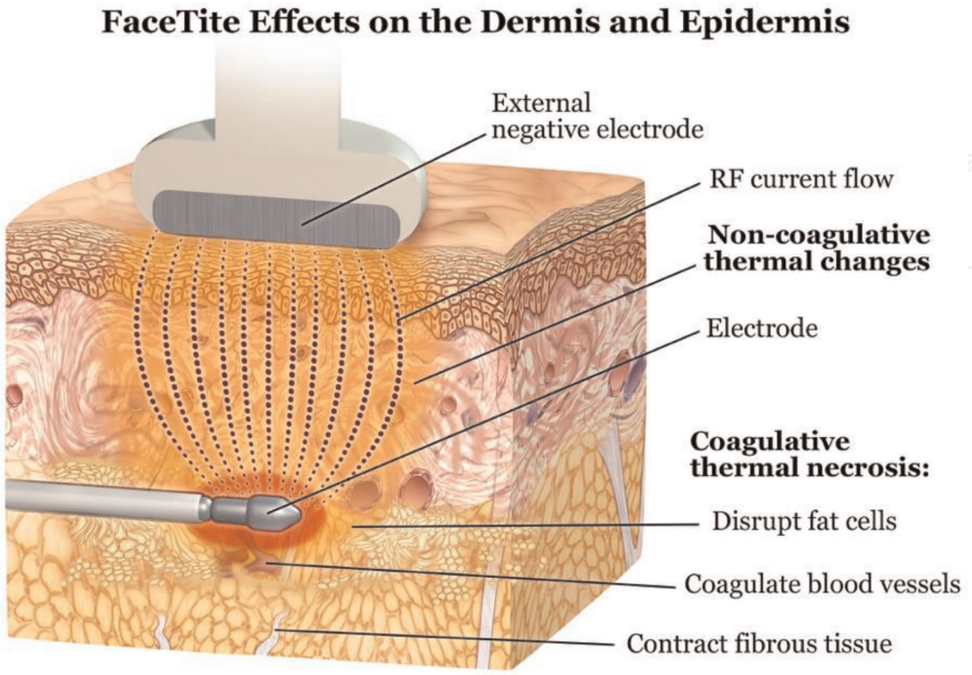

Figure 18.
For skin tightening and contraction, the FaceTite is passed with the superficial fat just under the dermis. Always leave 3–6 mm of fat between the internal electrode and the dermis. Adipose coagulation and dermal remodeling lead to tightening of the skin. Aspiration may or may not be performed depending upon the area.

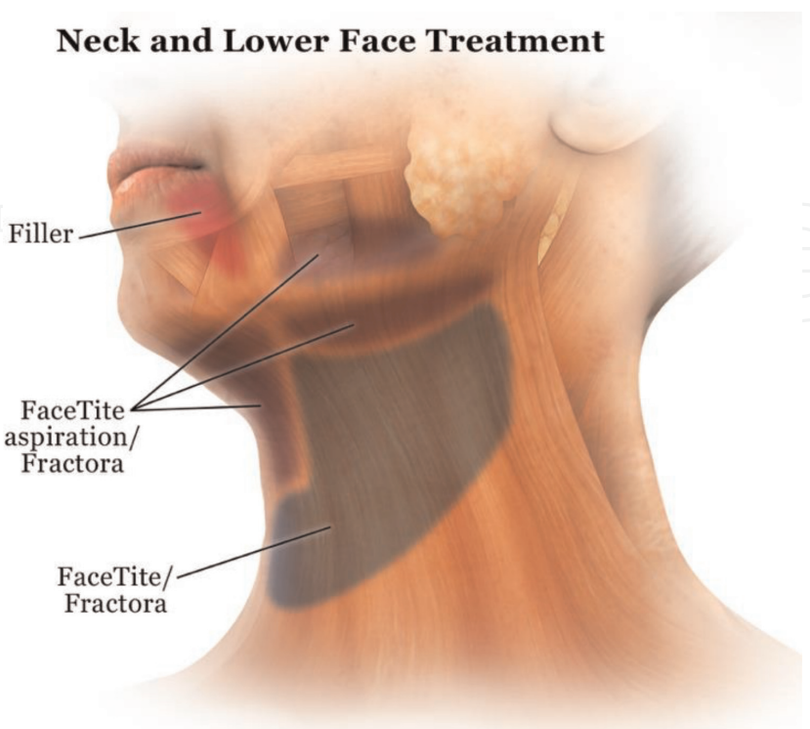

Figure 19.
The FaceTite® can be used superficially to deliver skin tightening without aspiration (jawline) or within the jowl, submental and neck fat and modest aspiration performed after for contour.

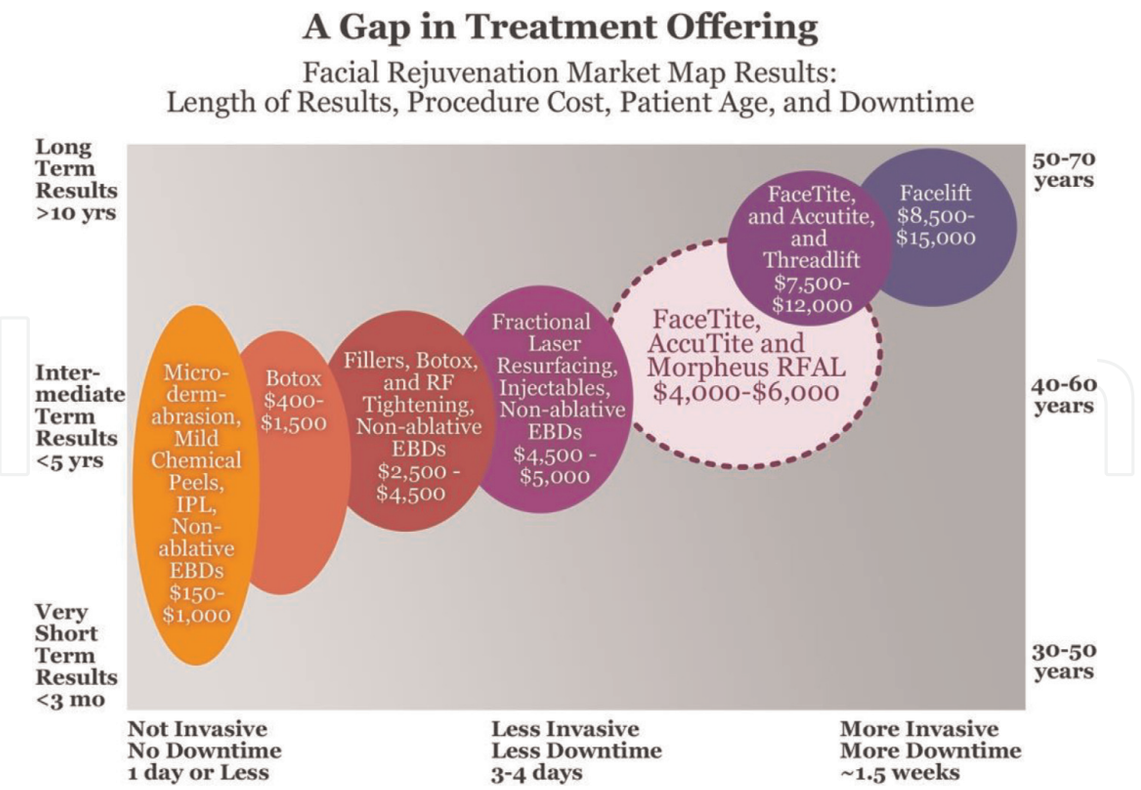

Figure 20.
The FaceTite® and AccuTite® can fill the gap in therapeutic options between more aggressive excisional procedures, like a facelift and the completely noninvasive external energy-based device (EBD) treatments and injectables.

electrode up to the external electrode, there is a "thermal containment" which is not present in other mono-probe systems, minimizing a thermal neuropraxia of the marginal mandibular branch of the facial nerve (**Figure 17**).

When performing RFAL along the jawline, the FaceTite RFAL lipocoagulation is executed using a slow moving and/or stamping technique within the superficial fat, just under the dermis (**Figure 18**). Always leave 3–5 mm of fat between the internal electrode and the dermis. The thermal endpoints are 69° in the superficial fat (US systems), a popping sound (International) and a skin cut off temperature of 38–40°. The FaceTite® can be performed just under the skin of the jawline and jowl to create significant skin tightening and firming of the jawline with reduction of the Jowl. Minimal or even no suction may be used in this region.

When using the FaceTite in the submentum and neck, the internal electrode is passed through the submental fat pad, coagulating the adipose and delivering soft tissue contraction with deep endpoints being 69° (USA) or popping (International) and the skin temperature is brought to 38–40° (**Figure 19**). In the submentum and neck, suction aspiration is performed after the heating if there is a fatty deposit.

The FaceTite® and the newer AccuTite® can provide the liposuction surgeon with a procedure that "bridges the gap" between non-invasive face and skin tightening and the more invasive excisional procedures like a facelift (**Figures 20**, **21**).

The FaceTite ®can also be used for small, focal liposuction body zones with little fat, to ensure soft tissue contraction prior to aspiration. Zones such as the upper arms, inner thighs, upper abdomen, as well as the jawline and neck as easily treated with the FaceTite®.

Figure 21.
Top panel is FaceTite® of the jawline and jowl, with FaceTite® and Morpheus of the neck. Bottom panel is FaceTite® and liposuction of the submentum and neck.

7. CelluTite

The CelluTite hand piece has a V-dissector shape plastic tip, rather than bullet shaped and is used to treat advanced, grade 3 nodulo-pitted cellulite of the buttock and thighs. The hand piece is 2.4 mm × 17 cm long (**Figure 22**).

The CelluTite® is designed to treat the three anatomic pathologies of Cellulite

i. nodules,

ii. pits, and

iii. dermal thinning with adipose herniation.

Cellulite patients tend to have a more vertically oriented FSN anatomy and, over many years there is a contraction of many of the vertically oriented fibroseptal bands and edema of the superficial fat which leads to the pits and nodules characteristic of more advance cellulite (**Figure 23**).

The CelluTite® patient is marked out in the standing position and all deep pits are marked for release, while the nodules are marked using a different color and are targeted for stamping and popping to reduce the nodules. The thinned dermis, that allows superficial fat herniation is then heated, thickened and minimizes the ability of superficial fat to herniate into the dermis.

Only superficial tumescent anesthesia is required (first 4–6 cm of soft tissue) and a tense tumescent infiltration is instilled. The entire treatment is performed at level 2 on the CelluTite® depth setting. The procedure is divided into releasing the

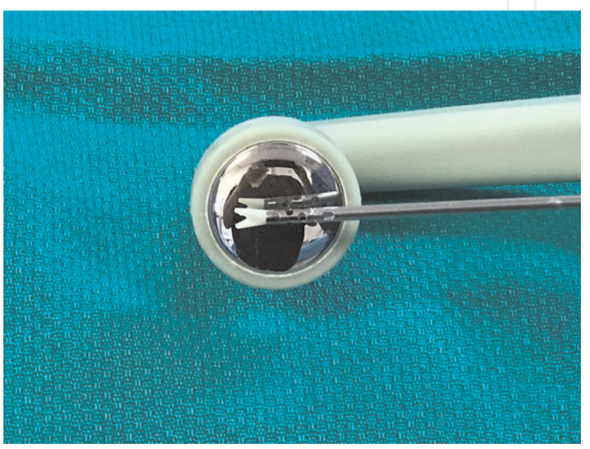

Figure 22.
The CelluTite® has a V-shaped tip, making the CelluTite® a thermal V dissector. The V-tip, traps the vertical, shortened, fibroseptal band that pulls down the dermis causing the deep skin pits. The band undergoes a thermolysis, release the pit and smoothening the skin.

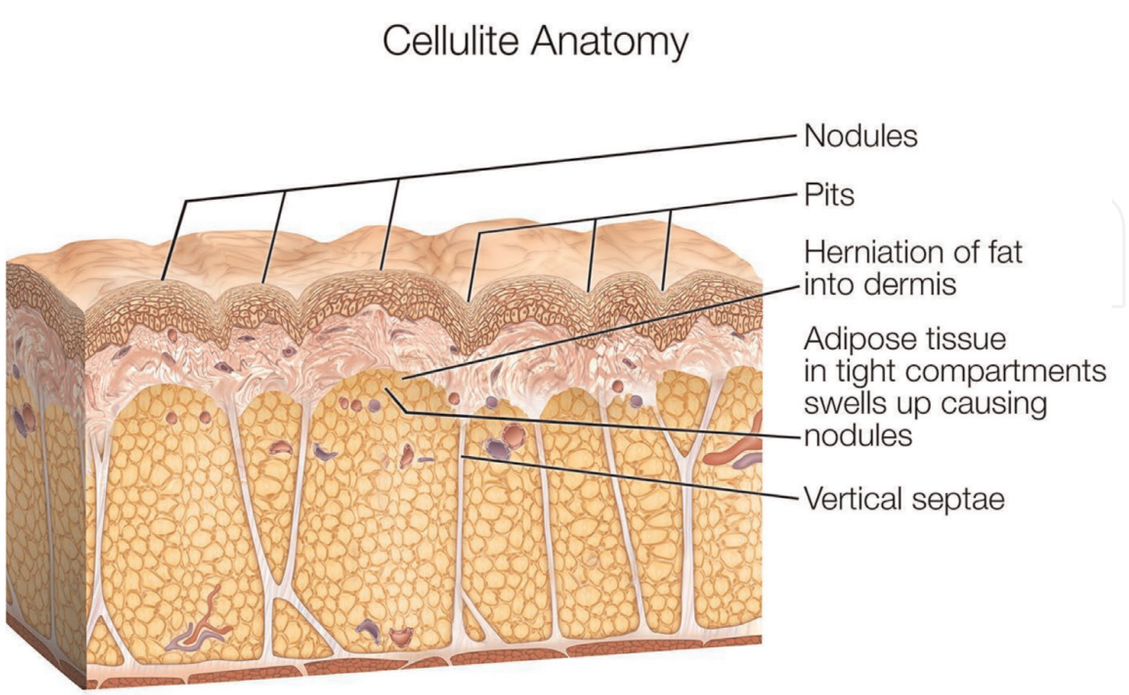

Figure 23.
The anatomy of cellulite: the FSN tends to be more vertically oriented. The pits are caused by shortened fibroseptal bands. Nodules result from edematous, swelling of superficial fat from the microcirculatory compromise. The dermis is thin, leading to fat herniating into the reticular dermis.

pits, followed by coagulation and reduction of the nodules. To release the pits, CelluTite tip is advanced the slowly at several levels across each pit. The thermal V-dissector captures the contracted FSN which is causing the dimple at the apex of the V (**Figure 24**) and bends the FSN over the RF emitting internal electrode, result in a thermoseptolysis and release, which allows the pitted skin to "pop back up" and smoothen the pitted appearance to the skin.

Additional smoothening is then achieved by moving the internal electrode up under a pre-marked nodule and performing a stationary stamping technique under each nodule and heating until the cutoff of 69° is achieved (USA) or, for International physicians, for 2 s, until there is a "popping" sound, both of which coagulate the edematous herniated fat, flattening the area and smoothening the contour (**Figure 25**).

Once all the pits and nodules have been successful performed, slow back and forth passes are made under the soft tissue until there is no FSN resistance with each pass and the external skin temperature reaches the pre-set cut off of 38–40°C. This will provide additional dermal thickening, minimizing herniated dermal fat (**Figure 26**).

Excellent long term CelluTite® results can be achieved with a single treatment, often 50–70% reduction (**Figure 27**) which can last for many years (22). Recurrent nodulo-pitted irregularity is prevented by the creation of more multi-directional FSN, than the vertically oriented anatomy that contributed to the deformity and this multi-directional, remodeled FSN is resistant to any single fibroseptal band to shortening and causing a deep pit (**Figure 28**).

CelluTite® can be performed at the same time as BodyTite® and aspiration liposuction. Generally, in combination cases, CelluTite® of the buttock, posteriorly

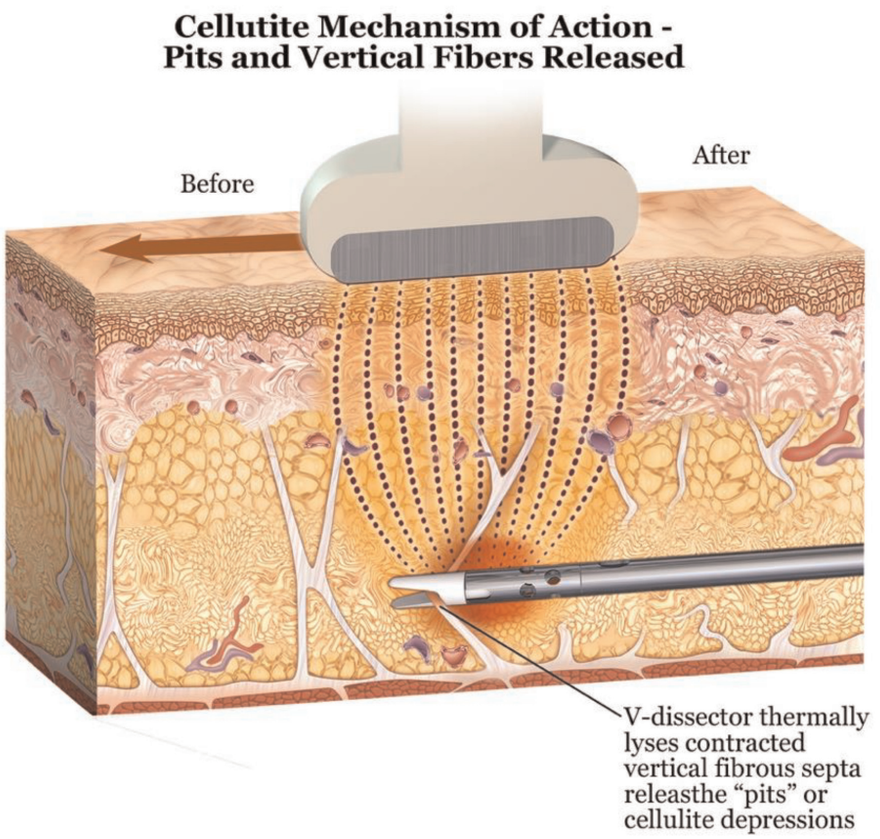

Figure 24.
The thermal V dissector captures the shortened vertical fibroseptal band(s) in the apex of the V and bends the band over the thermal electrode causing a thermoseptolysis and band division. This slow back and forth release is repeated a several vertical depth, providing a thorough release. This allows the pitted skin to "pop' back up smoothening the overlying skin.

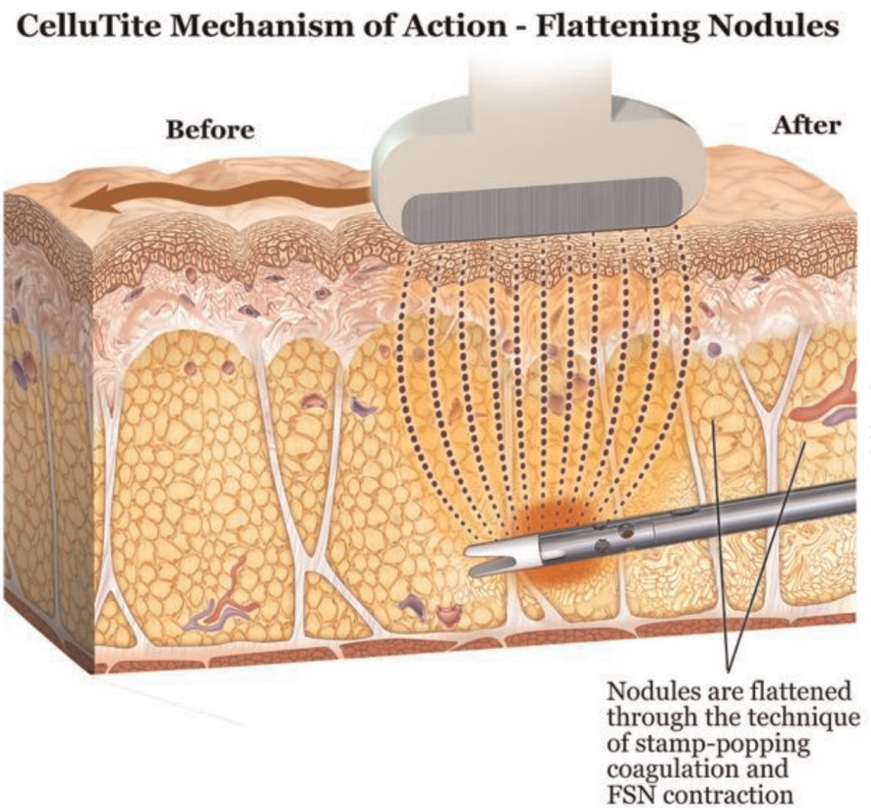

Figure 25.
The CelluTite® applicator is placed under a nodule and a stationary stamping technique is performed causing coagulation of the nodule (70° cut off in the USA BodyTite® platforms and popping after 2 s in international BodyTite® systems). This coagulates the edematous fat and flattens the nodular skin.

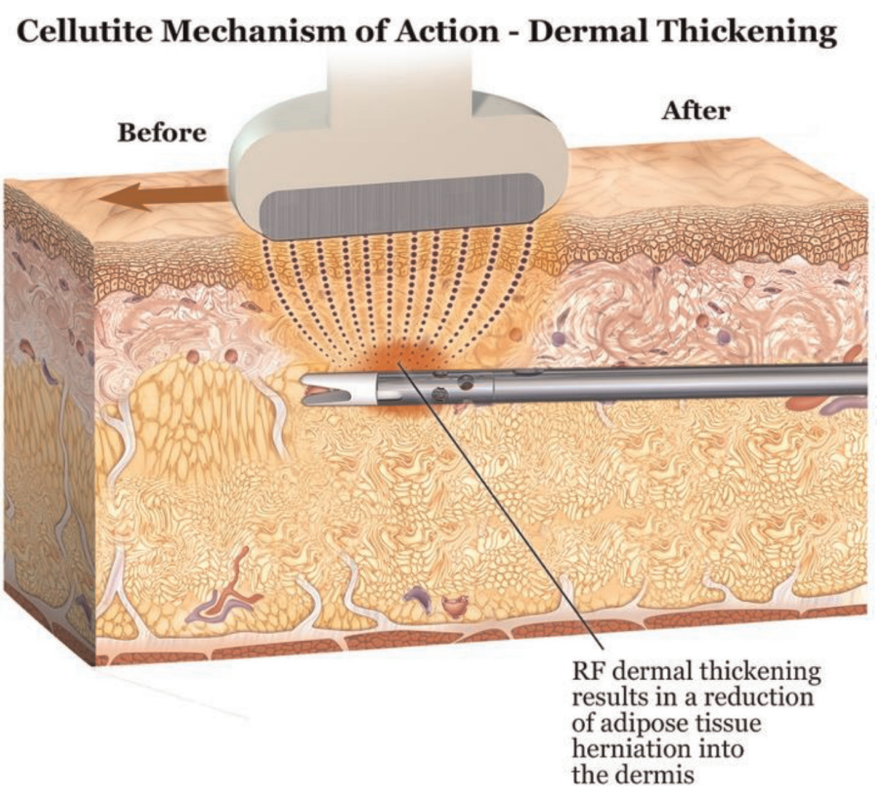

Figure 26.
The skin and dermis are then heated to 38–40°C superficially and the subdermal space to 69° (US systems), thickening the dermis and reducing fat herniating into the dermis.

and laterally is performed superficially first, follow immediately by BodyTite® RFAL liposuction of the outer and inner thighs second.

Non-invasive suction coupled RF devices such as the BodyFX®, Velashap. 3®, Venus Legacy® and others can be used after 6 weeks of garmenting to maintain the outcome and protect the patient's improvement.

Figure 27.
Long term, 36 month results of CelluTite of the buttock.

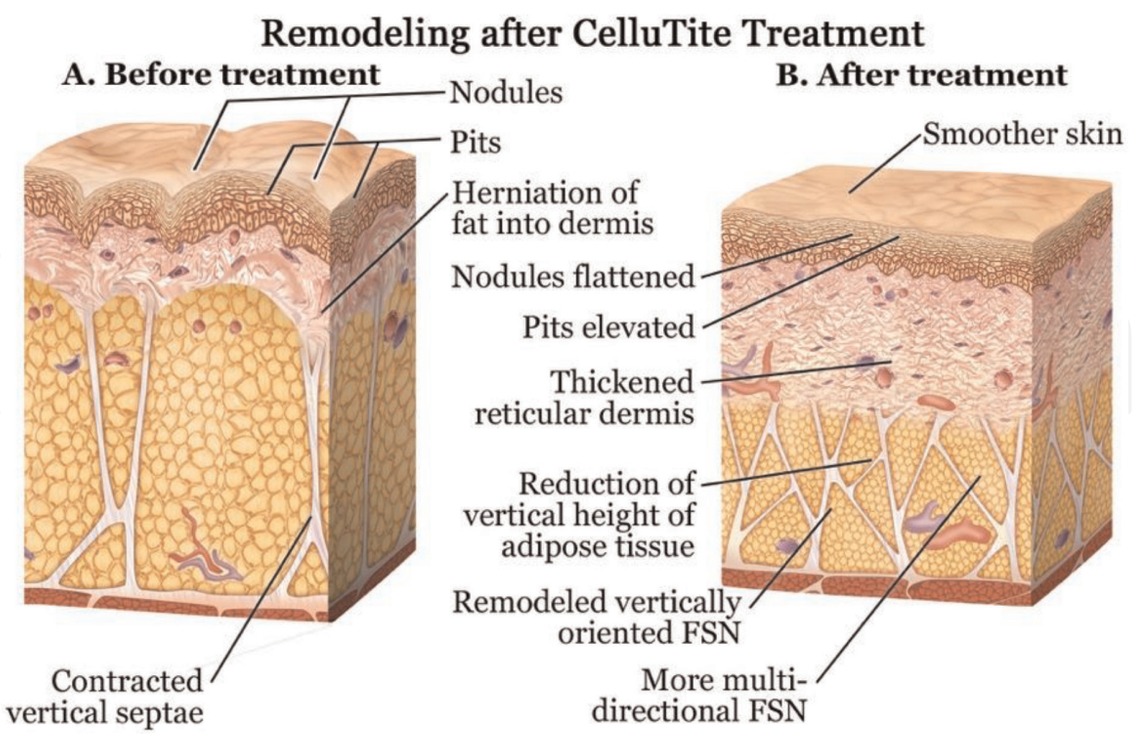

Figure 28.
With release of the pits, flattening of the nodules and thickening of the skin, the remodeling process leads to a more multi-directional FSN network, which is resistant to shortening of individual bands and nodular swelling of the fat.

8. AccuTite®: injectable RF and skin tightening

The AccuTite® is the newest and smallest of the BodyTite® RFAL applicators and can be deployed on any of the BodyTite® workstations (the 20 W and the 40 W BodyTite® Pro as well as the new Embrace RF workstation). The AccuTite® has all the thermal, impedance and contact automated monitoring and feedback as the BodyTite®, FaceTite® and CelluTite® applicators, but it is very versatile by nature of its tiny size. The internal solid, silicone coated electrode is only 0.9 mm in diameter and is 8 cm long. The entire Bipolar RFAL applicator can fit easily into the palm of your hand (**Figures 29**, **30**). The AccuTite® is smaller than most of the conventional microcannulas being used to inject soft tissue fillers in the deep subcutaneous and supra-periosteal space (**Figures 29**, **30**). The AccuTite® appeals to virtually every physician, both the surgeon and non-surgeon users who are looking for safe, predictable, non-excisional methods of coagulating fat and tightening skin. Physician users can think of AccuTite® as *Injectable RF and Injectable skin tightening*.

The small size of the AccuTite® allows the physician us use a small #21-gauge port creation needle anywhere on the face, neck and body where skin needs to be tightened, with or without lipoaspiration. Once under the skin, the stamping and moving techniques for thermal coagulation are deployed, with the cut off temperatures of 69° internal and 38–40° external being deployed. When used subdermally for skin tightening, no aspiration is required.

The AccuTite® can be used to coagulate fat and tighten the FSN prior to liposuction and aspiration in very small zones. The #21-gauge port needle site need not be closed with a suture and the physician can simply "pop in and out" of lax skin zones all over the body, including the upper and lower lid and perioral, jawline and neck (**Figure 31**).

Figure 29.
The AccuTite® is the smallest of the RFAL hand pieces. It is 0.9 mm in diameter and can fit into the palm of your hand. The internal electrode is inserted under the skin to remodel the deep reticular dermis to 70°, while the external electrode will move along the surface of the skin and heat to 40–42°. The AccuTite® is shown above, next to a commonly used 22 gauge microcannula and the internal AccuTite® electrode is actually smaller. A 21-gauge needle is used to create an insertion port for the AccuTite®, which is then inserted under the skin and RF is injected under the dermis, resulting in skin and soft tissue tightening, hence, the ***term injectable RF.***

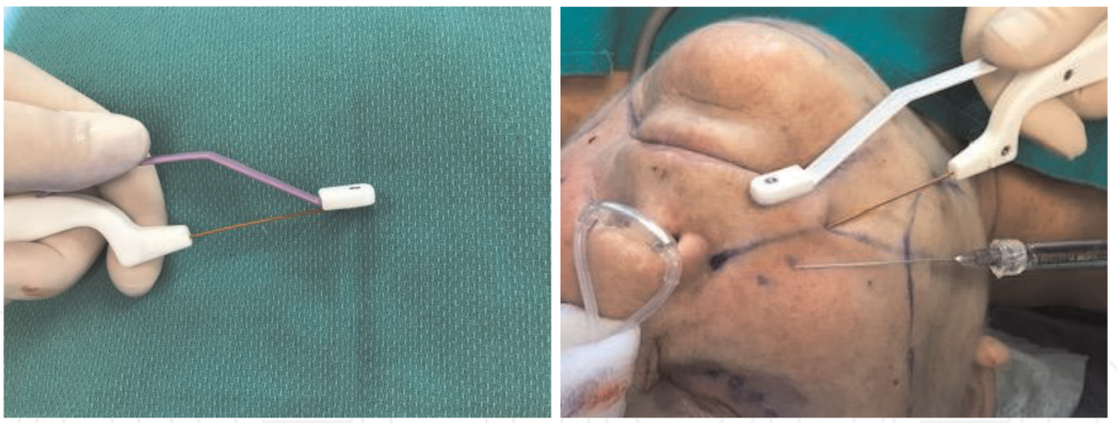

Figure 30.
The AccuTite ®is small and easy to control. Above it is being used to tighten the para-nasiolabial smile line tissue and, following that, Juvederm is being injected through the same plane at a deeper level. The AccuTite® can be used under local anesthesia together with your soft tissue fillers and at the same time, often using many of the same tactics and skill sets.

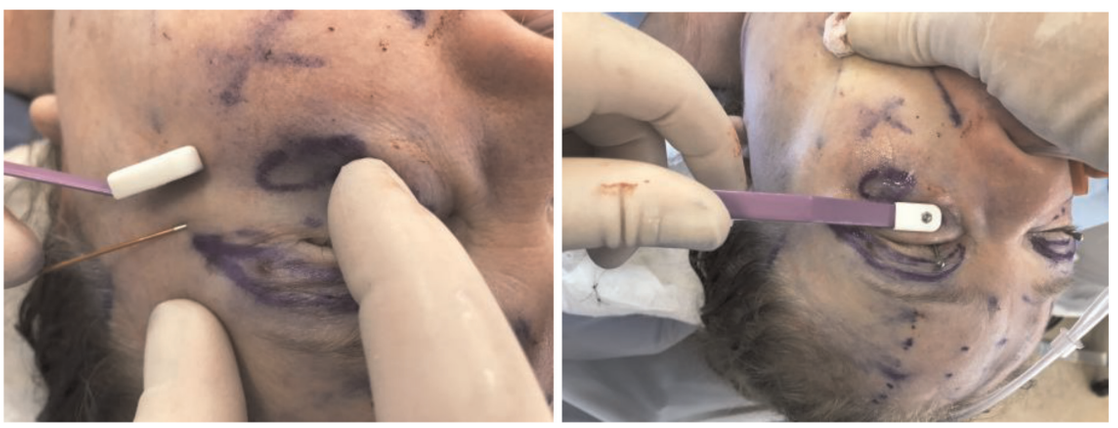

Figure 31.
The small, compact size of AccuTite® and the small size of the internal and external electrode, allows this versatile RFAL applicator to gain access to areas of loose skin all over the face, neck and body. Despite its small size, the sub-dermal space is heated quickly and effectively to the same thermal endpoints as are used by BodyTite ® and FaceTite®, with the thermal endpoint of the subdermal space being 70° and the skin cut-off of 40°C. Skin tightening is significant and the small port access means a suture is not even needed for an access port.

9. Morpheus: external RFAL

The Morpheus is an externally applied fractional radiofrequency assisted lipocoagulation (RFAL) device that has been developed to help tighten and contract soft tissue, and contour superficial fat and skin texture at the time of liposuction, or as a stand-alone procedure. For the liposuction surgeon, once the BodyTite®, FaceTite®, AccuTite® or CelluTite® device has been deployed and the aspiration of the fat completed, a final step of lipocoagulation can be performed using the Morpheus, from *"outside the skin in"*. The Morpheus is an external applicator, loaded on the BodyTite® and Embrace RF workstations that delivers 24 silicone coated pins into the superficial, subdermal layers of the fat. Think of each pin-triangular exit point as a tiny BodyTite electrode system. Each pin is 300 microns in diameter, has an uncoated tip and is positively charged. The physician can control the depth of the pin extrusion and a 100 ms RF pulse of positively charged current is emitted upon

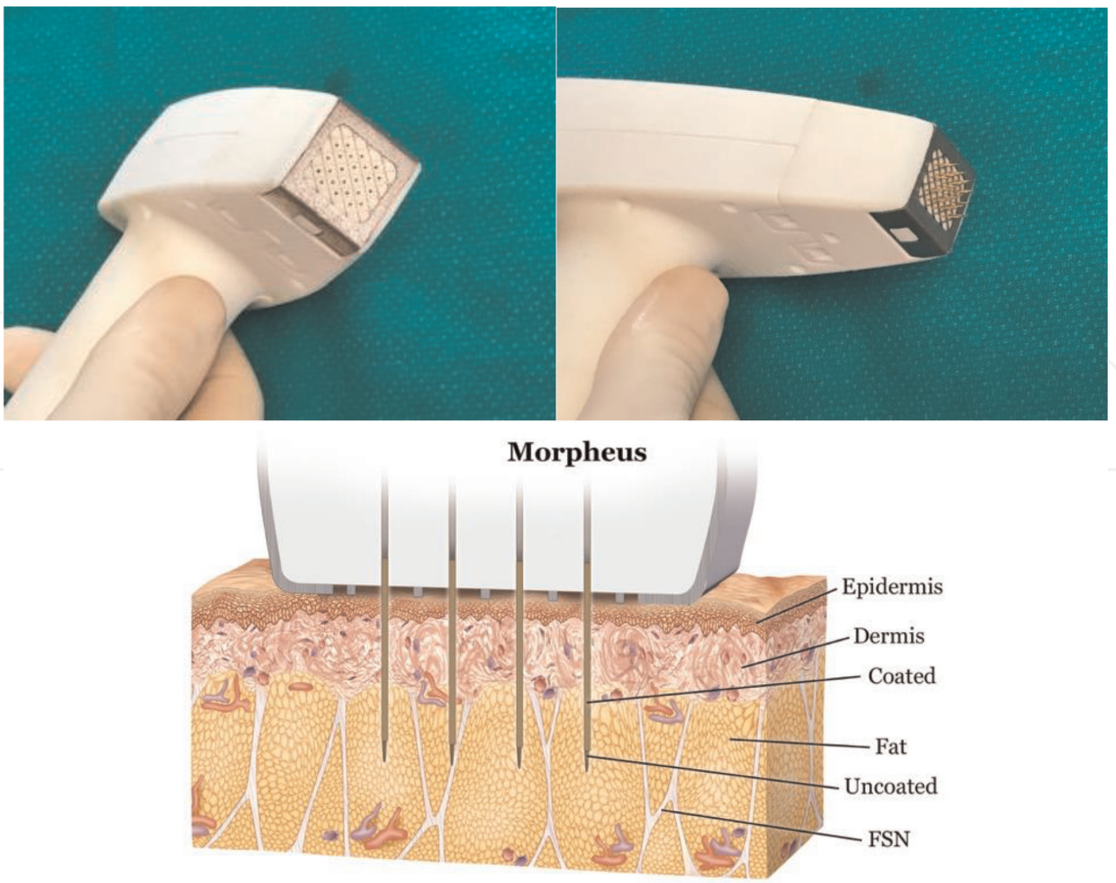

Figure 32.
The Morpheus is an external applied micro bipolar RFAL device, that emits a 24 pin, positively charged array into the adipose tissue under the skin. Each needle, like RFAL, is a positively charged electrode that penetrates the fat and then releases ablative RF energy that flows up to a negative electrode on top of the skin.

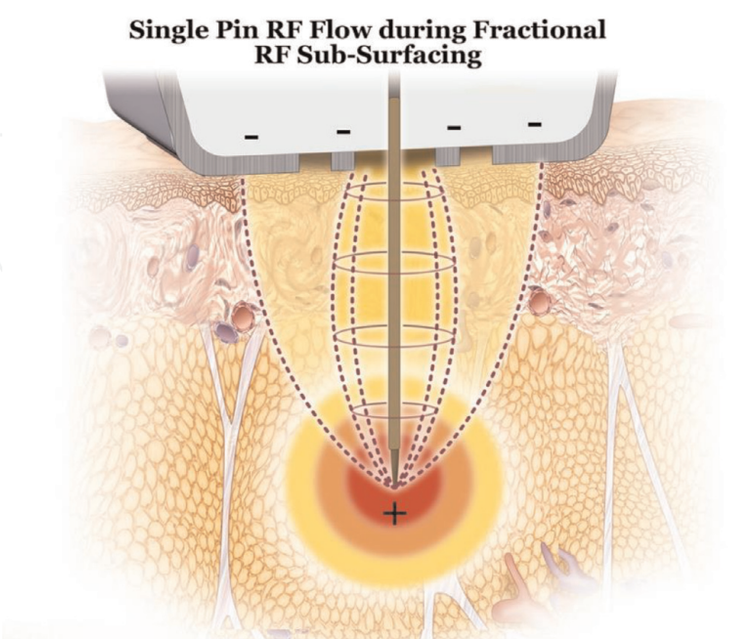

Figure 33.
The tiny, coated, positive charged electrodes are inserted into the superficial fat, and, when the RF energy is released, a zone of ablation and adipose coagulation is created with each pulse, leading to FSN contraction and soft tissue contouring and tightening. The RF flows up to the negatively charged triangular shaped electrodes which creates a strong, non-ablative dermal remodeling effect of the each of the.

maximal extrusion. The triangular shaped exit point of the pin, is negatively charged and acts as the primary return electrode for the flow of RF from the tip of the pin, created a bipolar lipocoagulation system similar to BodyTite® (**Figure 32**).

Like BodyTite®, the Morpheus emits RF energy is ablative and coagulative near the uncoated tip of the pin and then, the RF energy flows strongly up the coated pin to a triangular shaped negative electrode. The RF pulse creates a zone of ablation several hundred microns in diameter that coagulates the fat and tightens the FSN (**Figures 33**, **34**). The RF current then flows up the pin to the negatively charged, triangular electrodes located at pin exit sites on the tip to provide a bipolar, non-ablative thermal stimulation effect on the reticular and papillary dermis (**Figures 33**, **34**). RF also flows form the positively charged, mono polar pin tip to the widely space negatively charge rails on the sides of the tip for a gentle sub-necrotic heating and the entire zone (**Figures 33**, **34**).

Basically, each of the 24 needles acts like a mini-BodyTite® internal electrode. Because the needle is silicon coated, there is no thermal epidermal-dermal effect

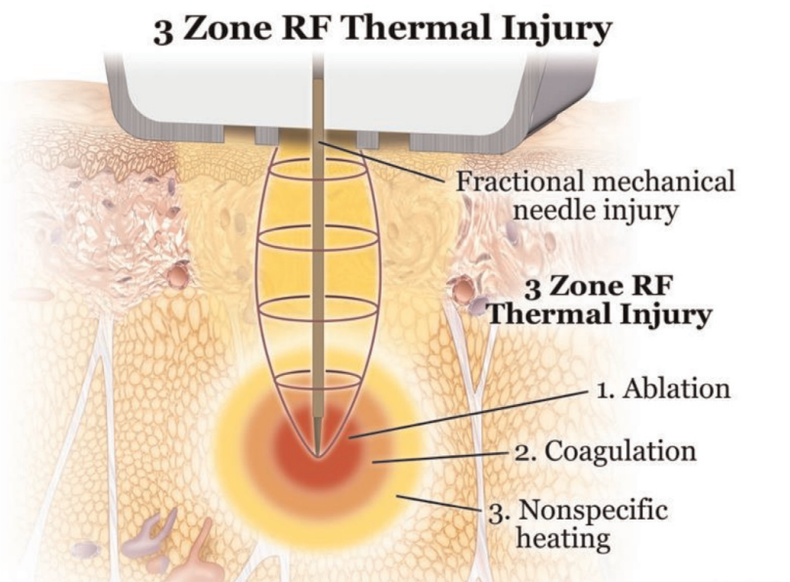

Figure 34.
The zone of ablation and adipose coagulation contracts the FSN and contracts the soft tissue. The flow of RF up to the negative electrodes creates a more gentler, sub-necrotic, non-ablative heating and tightening of the dermis.

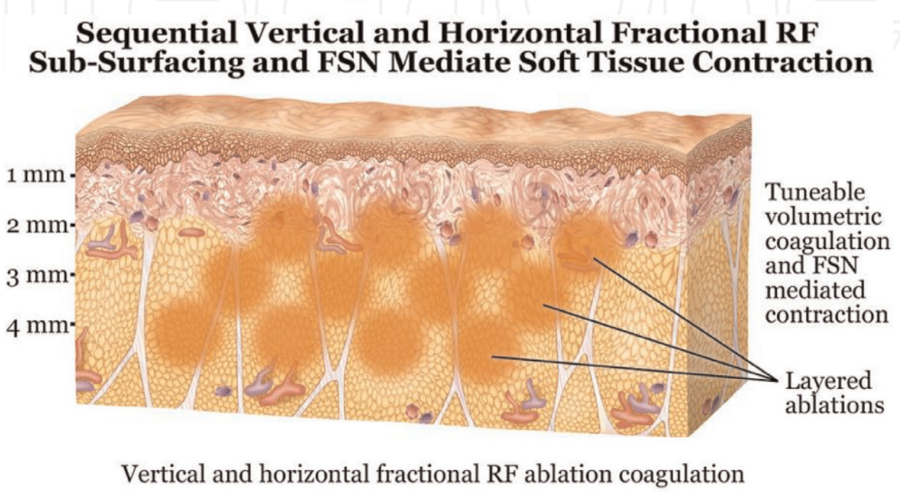

Figure 35.
Multiple pass and variable depth Morpheus will lead to vertical sequential FSN contraction, contouring and skin tightening.

and the ablation occurs around the positively charted, uncoated tip and is within the superficial fat using the FSN as the main vehicle for soft tissue contouring and tightening (**Figures 33**, **34**).

The physician can set the pin penetration depth to periocular (approx. 2 mm), face (3 mm) and body (4 mm) and treat at multiple sequential depths to create a vertical and horizontal fractional thermal stimulation and optimal contraction. The Morpheus is an excellent final step in BodyTite®, FaceTite®, AccuTite® and CelluTite® treatment to obtain superficial liporeduction, lipocoagulation and soft tissue tightening.

Like with BodyTite®, multiple passes of the Morpheus will allow the physician to create a vertical thermal lipocoagulation with skin tightening and remodeling. This horizontal and vertical thermal lipocoagulation leads to excellent skin tightening and can be done in contraction (**Figure 35**, **36**).

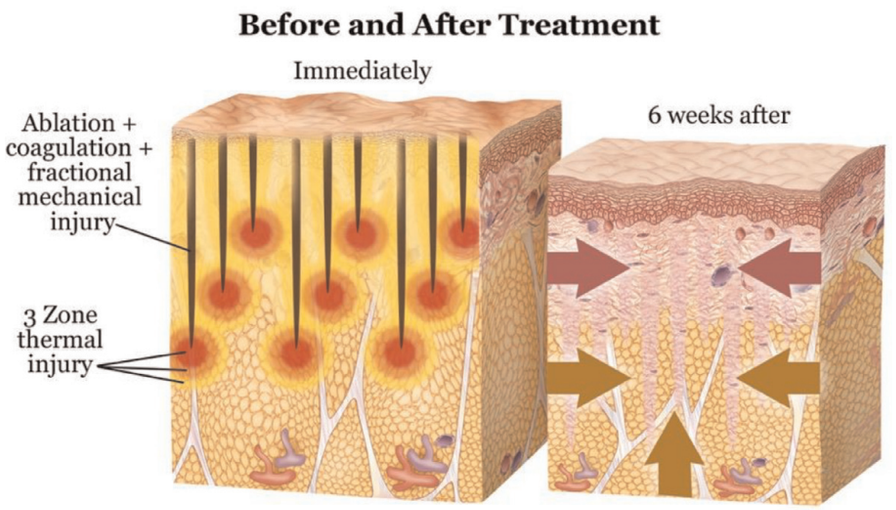

Figure 36.
Multiple pass, sequential vertical and horizontal Morpheus RFAL will lead to 3D soft tissue contraction and tightening.

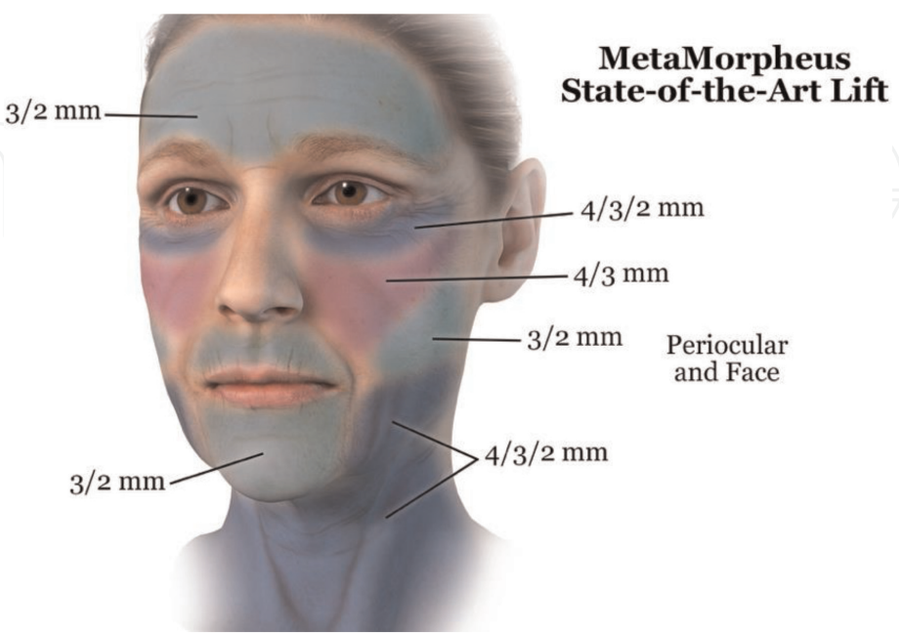

Figure 37.
The Morpheus can afford the liposuction surgeon, an external mini RFAL device that delivers 24 tiny mini BodyTite RFAL thermal injury injuries and can result in significant skin contraction. This can provide a nonexcisional face and necklift like result.

Figure 38.
CelluTite® or BodyTite®, FaceTite® and AccuTite® can be combined with Morpheus to enhance the overall soft tissue contraction and skin tightening with an "inside out" and "outside in" thermal sandwich approach.

The Morpheus can be offered on the face, or body, and after a treatment with a BodyTite® liposuction procedure for enhanced contraction and skin tightening after liposuction (**Figures 36**, **37**).

When Morpheus is used on the face, multiple pass, multiple depth approach is used. The deep pass is ablative and coagulative in the deep layer, often the frontalis, orbicularis, SMAS and platysmal. The next pass coagulated the subdermal fat and the final pass into the fat of the subdermal space (**Figure 37**).

The Morpheus can be combined with BodyTite RFAL liposuction to improve overall soft tissue contraction and skin tightening (**Figure 38**).

10. Combination excision and RFAL

The ability to achieve significant BodyTite® RFAL contraction has opened a more minimal excisional opportunity for surgeons in achieving optimal contouring results with less invasive procedures. Mini intra-pubic skin pinch tummy tucks, removing infra-umbilical skin excess with BodyTite® RFAL upper and lower abdominal lipocoagulation and aspiration can achieve results of a full abdominoplasty, with less scarring when the rectus abdominus diastasis is not significant. Axillary mini-brachioplasty with BodyTite® lipocoagulation and aspiration of the arm, limited incision, inguinal Anterior thigh lifting with BodyTite® liposuction to the inner thigh and lateral post or periauricular lateral face and neck-lifting with anterior compartment FaceTite® RFAL and lipoaspiration are all examples of combining BodyTite® RFAL applicators in combination with more minimal excisional approaches to achieve excellent results in selected patients.

By combining the contraction power of RFAL with more minimal limited excisional approach, a less invasive option between totally non excisional energy based device treatments and full excisional, more standard lifting is created that gives patients the option for a better outcome than an EBD without the excisional scars, or recovery of a typical open surgery. Often these BodyTite® assisted procedures can be performed as an outpatient, under oral and tumescent anesthesia and nitrous oxide inhalational, avoiding a full general anesthetic. This BodyTite® RFAL together with the mini-lift, give physician an *"in between"* option that is more appealing to patients and can give a superior outcome with less scarring or downtime.

11. BodyTite® RFAL and other liposuction technologies

BodyTite® RFAL is an industry leading lipocoagulation skin tightening technology and technique, with documented 35% soft tissue and skin area contraction. The physician still needs to perform final aspiration and contouring. Small, microcannula SAL, PAL (MicroAire, Vaser PAL or Tickle Lipo) are the most common aspiration options. UAL, Ultrasound assisted may be deployed prior to BodyTite®, particularly if fat grafting is being performed, as UAL will facilitate fat cell decohesion, separation and then aspiration and collection of the adipose tissue, BUT these adipocytes and adipocyte derived stem cells *will be viable* and survive the fat grafting process.

SmartLipo®, or laser assisted liposuction (LAL) is another viable thermocoagulation soft tissue tightening system, with documented 17% area contraction. LAL is not as efficient as RFAL with inferior published skin contraction data, but, is a very strong brand and can be easily marketed. Occasionally, the physicians with both SmartLipo® and BodyTite®, may use the laser lipolysis for a small, and often subdermal component of the procedure and then deploy the BodyTite® applicator for the majority of the thermal coagulation process. Propulsive water assisted liposuction (WAL), is gentle, with less bruising, but does not lead to enhanced soft tissue contraction, so is not a common technology in most regions of the world. Plasma assisted liposuction is relatively new and can deliver soft tissue contraction, but lacks internal thermal control, is relatively slow and plasma may be better suited and relegated to external skin resurfacing.

BodyTite® is usually the stand along soft tissue contraction system and can be performed before the final aspiration contouring or, after aspiration and contouring has been performed. There are no studies confirming which, RFAL before or after aspiration, delivers the best contraction and results. The author does prefer to perform BodyTite® RFAL first, not just to optimize the number of FSN architecture that can be shortened prior to aspiration, BUT, also to ensure, small venule and arterioles undergo a thermal coagulation and then, when aspiration is performed last, there is less injury and bleeding into the subcutaneous space with less patient ecchymosis. The coagulation and liquification of fat, means more gentle aspiration forces are required, which likely translates into less edema, swelling and pain.

12. RFAL complications

The use of body tight RFAL applicators has evolved into a very safe and efficacious tool. Over 10,000 procedures have been performed worldwide with a very low complication rate. However, like any surgical tool untoward outcomes can occur and the risk of complication is often proportionate to the therapeutic index of safety of the device and the experience of the surgeon. Fortunately, over the past 10 years of BodyTite® innovation in the thermal lipocoagulation, there has been a tremendous evolution in the onboard sensing of soft tissue thermal profiles and automated modulation of the radiofrequency output around those variables.

12.1 Thermal injury

Contact sensor, high and low impedance sensors, external and internal electrothermal cutoffs, audible warnings as temperature rises, automated cut off

Figure 39.
A small full thickness BodyTite® burn during abdominal RFAL treatment. Secondary intent healing and remodeling, with dilute triamcinolone (Kenalog 2) injections will result is a very cosmetically acceptable result.

temperatures, and energy output linked to the rate of rise of temperature with temperature surge protection are all part of myriad of onboard thermal control systems. Despite these safety features there is a small risk of a thermal injury. Because the heating from the subcutaneous level up through the, any thermal excess, any thermal excess will result in a full thickness burn. The vast majority these thermal injuries are small and limited nature and heal by secondary intent and occasional required excision once the scar has softened and remodeled (**Figure 39**).

This risk a thermal injury far less than 0.25% (1 in 400 cases) and diminishes with the experience of the physician. To minimize the risk of a burner thermal injury conservative settings and parameters as outlined in this chapter and advanced training environments and experience, together with an adequate amount of tumescent anesthesia, and avoid peri-port injuries will make out the risk of the thermal excess very uncommon. When a peri-port burn occurs in a esthetically sensitive region, like the face or neck, the author will perform an epidermal closure over the injury, rather allow secondary intent healing and perform fractional RF or CO_2 treatment once this is healed or, perform a secondary scar revision if necessary (**Figure 40**).

12.2 Nodules

In the past BodyTite® and its RFL applicators lacked the sophisticated internal thermal monitoring and overheating of the adipose tissue occurred that often led to fibrous lumps and deep subcutaneous scar tissue. These internal areas of firmness and hardening are now extremely uncommon with sophisticated internal and external thermal monitoring the parameters are adhered to.

12.3 Postinflammatory hyperpigmentation (PIH)

The risk of significant bruising following RFAL assisted liposuction bruising is lessened with RFAL mediated thermal coagulation of small venules and arterioles

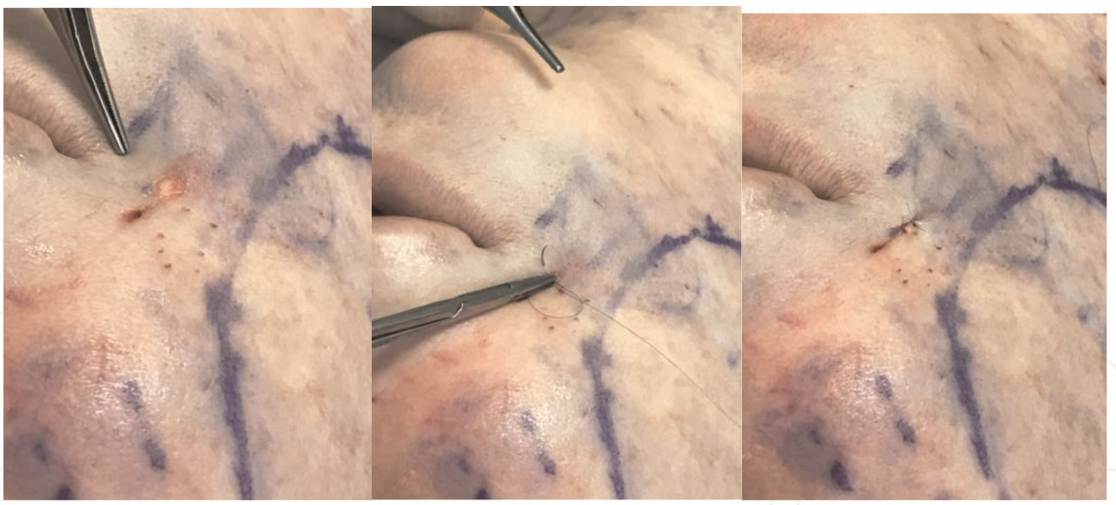

Figure 40.
A small peri-port FaceTite® burn at the entrance of the nasolabial port. Simple epidermal 6–0 nylon closure over the injury will allow subdermal secondary intent healing without an obvious scab. Subsequent fractional RF or laser treatments or, even delayed excision will minimize the risk of any deleterious visible scar.

and the resulting hemosiderin induced PIH is hence far less than lipocontouring with more ecchymosis.

12.4 Seroma

The risk of a seroma is higher using RFAL thermal coagulation is higher, most probably due to a temporary, but reversible injury to the subcutaneous and sub- dermal lymphatic system and so, an internal close drain is used by the author on all abdominal BodyTite® and RFAL cases. BodyTite® and RFAL to other anatomic regions does not increase the risk of seroma, so closed drainage is not deployed.

12.5 Sensory anesthesia

Sensory anesthesia and, to some extent, dysaesthesia is more common with thermal lipocoagulation that non thermal lipoplasty and the during of recovery is longer (more like flap elevation). The reason for the more significant anesthesia is the effect of thermal coagulation resulting in a demyelinating effect of the sensory nerves, but generally 95% of patients get 95% return of sensation.

12.6 Injury to deeper structures

A good working knowledge of the anatomy of the region treated with the BodyTite® applicators will minimize deep internal thermal coagulation of sensitive vascular or neural structures. The most common reported injuries following BodyTite® when looking the worldwide literature would be damage to the antebrachial nerve of the upper arm and typically there's a normal return of sensation, but occasionally permanent anesthesia can occur. Damage to motor nerves should not occur if one performs the RFAL in the correct subcutaneous plane. After 10 years of FaceTite® and AccuTite® to the face and neck, the author does not have a single case of permanent weakness of the marginal mandibular branch of the facial nerve. Because of the thermal containment of the bipolar RFAL, there is little to no heat below the internal electrode, which, when passed above the SMAS, platysma, orbicularis oculi and other facial

muscles, the facial nerve is safe. Temporary neuropraxia of the marginal mandibular branch can occur, but this is typically from traction following aspiration and not a thermal injury.

12.7 Prolonged brawny and edema of the skin and dermis

BodyTite® and the RFAL applicators do lead to a more significant soft tissue contraction than any other liposuction assisted device. However, the thermal stimulus stimulation can result in a prolonged thickness and brawny edema of the skin that may take many months to settle. It is been the authors experience that this is uncommon when the focus is deep subcutaneous FSN mediated stimulation, rather than excessive dermal heating. Conservative superficial temperature and end points of 38–40°C are deployed. Because most of the contraction in the body zones relies on the deep FSN and three-dimensional contraction of this FSN, the author generally does not heat closer to the reticular dermis that 1–2 cm. However, when treating in the neck, face and the upper arm, more focus on dermal stimulation is required to gain the contraction and combination with the Morpheus, or RFAL from the "outside in" is safer.

With appropriate patient selection, the risk of excessive skin laxity should be minimal. Most RFAL patients will achieve up to 35% area contraction and reasonable patient selection should result in a significantly high proportion of happy patients that would not have otherwise been liposuction candidates. Perry port burns.

BodyTite® RFAL is a highly sophisticated thermal coagulation system with a multitude of onboard automated, thermally monitored safety systems. It is to a testament to the safety of the system that the tens of thousands of treatments over the past 10 years have resulted in very few serious complications and has made BodyTite® the most effective and safest thermal coagulation body contour tool and in the esthetic space.

13. Conclusions

The BodyTite® workstation has become one of the world's most commonly used thermal coagulation liposuction system. The advantages and opportunities afforded the BodyTite® RFAL physician include:

i. Optimal soft tissue contraction using both the FSN mediated 3D contraction and dermal remodeling.

ii. Studies show upwards of 35% areas contraction after 12 months.

iii. An elegant array of automated feedback thermal control features that minimize over heating of adipose tissue and thermal complications that can ensue.

iv. The ability perform liposuction more effectively on patients with more skin laxity and larger BMI's.

v. The ability to offer outpatient, local anesthesia procedures that combine RFAL and more mini lifts with excellent result, less scarring and downtime.

Conflict of interest

Dr. Mulholland teaches physician workshops on the RFAL technology and is a paid consultant of InMode® and a patent contributor.

Author details

Robert Stephen Mulholland
SpaMedica Plastic Surgery Center (Private Plastic Surgery Practice), Toronto, Canada

*Address all correspondence to: Mulhollandmd@spamedica.com

References

[1] Rohrich RJ, Beran SJ, Kenkel JM, et al. Extending the role of liposuction in body contouring with ultrasound-assisted liposuction. Plastic and Reconstructive Surgery. 1998;**101**: 1090-1102

[2] Zocchi ML. Ultrasonic liposculpturing. Aesthetic Plastic Surgery. 1992;**16**:287-298

[3] Zocchi ML. Ultrasonic assisted lipoplasty: Technical refinements and clinical evaluations. Clinics in Plastic Surgery. 1996;**23**:575-598

[4] DiBernado BE. Randomized, blinded, split abdomen study evaluating skin shrinkage and skin tightening in laser-assisted liposuction versus liposuction control. Aesthetic Surgery Journal. 2010;**30**(4):593-602

[5] Sasaki GH. Quantification of human abdominal tissue tightening and contraction after component treatments with 1064 nm/1320 nm laser-assisted lipolysis: Clinical implications. Aesthetic Surgery Journal. 2010;**30**:239-245

[6] Goldman A. Submental Nd:YAG laser-assisted liposuction. Lasers in Surgery and Medicine. 2006;**38**:181-184

[7] Illouz YG. Body contouring by lipolysis: A 5-year experience with over 3000 cases. Plastic and Reconstructive Surgery. 1983;**72**:591-597

[8] Gasperoni C, Salgarello M, Emiliozzi P, Gargani G. Subdermal liposuction. Aesthetic Plastic Surgery. 1990;**14**: 137-142

[9] Goddio AS. Skin retraction following suction lipectomy by treatment site: A study of 500 procedures in 458 selected subjects. Plastic and Reconstructive Surgery. 1991;**87**:66-75

[10] Matarrasso A. Superficial suction lipectomy: Something old, something new, something borrowed. Annals of Plastic Surgery. 1995;**24**:268-272

[11] Toledo LS. Syringe liposculpturing. Aesthetic Plastic Surgery. 1992;**16**: 287-298

[12] Paul M, Mulholland RS. A new approach for adipose tissue treatment and body contouring using radiofrequency-assisted liposuction. Aesthetic Plastic Surgery (online). 2009. DOI: 10.1007/s00266-009-9342-z

[13] Blugerman G, Schavelzon D, Paul M. A safety and feasibility study of a novel radiofrequency-assisted liposuction technique. Plastic and Reconstructive Surgery. 2010;**125**: 998-1006

[14] Mulholland RS. An in-depth examination of radiofrequency assisted liposuction (RFAL). Journal of Cosmetic Surgery and Medicine. 2009;**4**:14-18

[15] Paul M, Blugerman G, Kreindel M, Mulholland RS. Three-dimensional radiofrequency tissue tightening: A proposed mechanism and applications for body contouring. Aesthetic Plastic Surgery. 2010 (accepted, published with open access)

[16] Duncan DI. Nonexcisional tissue tightening: Creating skin surface area reduction during abdominal liposuction by adding radiofrequency heating. Aesthetic Plastic Surgery. 2013;**33**(8): 1154-1166

[17] Paul MD. Radiofrequency assisted liposuction comes of age: An emerging technology offers an exciting new vista in non-excisional body contouring. Plastic Surgery Practice. 2009;**2**:18-19

[18] Duncan DI. Improving outcomes in upper arm liposuction: Adding radiofrequency-assisted liposuction to

induce skin contraction. Aesthetic Surgery Journal. 2012;**32**(1):84-95

[19] Mulholland RS. Radiofrequency energy for non-invasive and minimally invasive skin tightening. Clinics in Plastic Surgery. 2011;**38**:437-448

[20] Blugerman G, Schalvezon D, Mulholland RS, et al. Gynecomastia treatment using radiofrequency-assisted liposuction (RFAL). European Journal of Plastic Surgery (published online). 2012. DOI: 10.1007/s00238-012-0772-5

[21] Duncan DI. Pilot study using RF assisted tissue tightening for non-excisional breast lifting. In: International Confederation for Plastic, Reconstructive and Aesthetic Surgery, IPRAS. Vol. 9, Issue 8. 2012. p. 76

[22] Divaris M, Boisnic S, Branchet MC, Paul MD. A clinical and histological study of radiofrequency-assisted liposuction (RFAL) mediated skin tightening and cellulite improvement. Journal of Cosmetics, Dermatological Sciences and Applications. 2011;**1**:36-42