

Effect of Radiofrequency-Assisted Liposuction (RFAL) Coagulation on Excisional Surgery: Risk of Complications and Vascular Necrosis

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ABSTRACT

Background: Patients often seek non-invasive and minimally invasive radiofrequency-based treatments for skin tightening and fat reduction prior to excisional procedures in order to avoid extensive visible scar burden. Some surgeons are concerned for vascular compromise or an increase in wound healing complications when patients present for surgical evaluation months or years after having radiofrequency-based treatments in the same anatomic area.

Methods: The study included 42 patients who underwent excisional body flaps after RF treatment, with no incidence of necrosis or delayed healing. Additionally, 111 patients underwent facial and neck procedures following radiofrequency treatment, with no cases of necrosis or delayed healing. Complications were limited to two cases of cellulitis, which resolved with oral antibiotics, and one hematoma and two temporary neuropraxias that resolved without intervention. However, we retrospectively reviewed 642 procedures where Radiofrequency-Assisted Liposuction (RFAL) had been performed on average 1.6 years prior to an excisional procedure. Anatomic regions included the face, neck, torso and extremities.

Results: There were no cases of flap compromise or delayed wound healing. There were two cases of cellulitis that resolved after a course of oral antibiotics, a neck hematoma that required evacuation and a temporary neuropraxia that resolved without intervention.

Conclusions: Excisional procedures that involve wide flap undermining can be safely performed after radiofrequency-based treatments in the same anatomic location.

Keywords: Hematoma; Neuropraxia; Cellulitis; Post-radiofrequency surgery; Non-invasive skin tightening

INTRODUCTION

Over the past 12 years, there has been a proliferation of minimally invasive Radiofrequency (RF) bipolar-assisted lipo-coagulation systems paralleling the growing patient demand for skin tightening and rejuvenation. These devices are designed

with components that emit RF internally, externally or from both directions. Wall Street financial forecasts project the accelerated growth in the radiofrequency skin tightening market to continue at staggering rates in the 5-10 years [1]. Internal bipolar Radiofrequency Assisted Liposuction (RFAL) contraction coagulation systems such as BodyTite, FaceTite and AccuTite

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Lake Forest, CA) along with external fractionated RF systems (i.e., Morpheus8) (InMode, Lake Forest, CA) can be utilized in the operating room or in office-based wide awake procedures [2,3]. These bipolar RF devices create zones of ablation and irreversible coagulation to liquefy adipose tissue leading to volume reduction and significant contraction of the fibro-septal network, also known as the FSN. Additional benefits such as dermal remodelling and neocollagenesis further buttress the clinical result. Studies published on the RFAL technology and peer-reviewed journals show between 40% and 60% three-dimensional soft tissue contraction [3,4]. With these procedures, patient satisfaction scores remain high with a favorable complication profile [5-7]. There is also a component of non-ablative papillary dermal remodeling along with subsequent neocollagenesis to give total tissue, both dermal and subcutaneous tightening. Controlled thermal coagulation of the dermis is most commonly followed by post-RFAL aspiration maximizing body contouring results.

Since receiving FDA clearance in 2016, the number of RF-based skin tightening procedures continues to grow annually [8]. The bipolar RFAL coagulation systems manufactured by InMode (Lake Forest, CA) have been particularly popular due to real-time monitoring of the external and internal thermal temperatures. The adjustable temperature cut-offs set by the provider can be customized for each patient and anatomic location further safeguarding against undesirable thermal injuries to the skin. With the use of an internal and external thermal cut-off sensors, contact, high and low impedance and rate of rise of temperature cut-offs measured 1000 times a second, an automated RF outflow can be controlled and thermal profiles optimized while ensuring adequate safety margins. A recent case study found that BodyTite (InMode, Lake Forest, CA) was the most frequently represented device for bipolar skin tightening devices in the literature [9]. The authors also found a lower rate of major complications when using bipolar devices compared to monopolar devices [9]. Human *in vivo* tissue studies have demonstrated that 69°C is the optimal temperature for FSN contraction and temperatures that exceed 70°C, lead to fibrosis, neural injury, stiffness, discomfort; thus, the internal dermal cut-off at 70 degrees appears to be an important element of safety during controlled FSN contraction and soft tissue coagulation. Monitoring the external dermal temperature and maintaining a constant temperature of 40 to 43°C also optimizes surface dermal remodeling (neocollagenesis) [10].

The emergence of this technology offers surgeons a non-excisional alternative for patients that desire notable contour results while avoiding the scar burden of resective procedures. RFAL has become a “gap” option for patients seeking contraction, tightening and contouring since it delivers superior results than previous non-invasive technologies without the risk, recovery, stigma and financial burden of excisional surgery. Published articles on this “gap patient” opportunity gave cosmetic physicians and surgeons access to a much broader market than excisional alone [5,6,11].

An array of RFAL applicators exist, of various sizes, designed to optimize efficiency and precision depending on the anatomic

area for a given treatment. The smaller tips are intended for procedures that treat less surface area and areas with more convexity and concavity. These can be performed under local anesthesia in the office with minimal down time without the stigma and scars of excisional surgery, recovery or cost. The most recent innovation, external fractionated RF with the Morpheus8 device (InMode, Lake Forest, CA), sends an array of positively charged micro electrodes (called “needles” in the literature erroneously) down to depths of up to 8 mm for the delivery of heat and up to 7 mm for ablation. At these depths, even though it is an externally applied device, the vertical sequential adipose coagulation and FSN contraction of fat can mimic the clinical effects of the minimally invasive internal RFAL applicators. There have been over 40 articles published on external Morpheus8 or internal RFAL techniques with excellent results. The safety profile based on FDA submission data of complications has been extremely low, estimated at 0.0013% [12].

There has been controversy at national plastic surgery conferences and amongst key opinion leaders of excisional surgery that the use of these RFAL applicators may result in later difficulty during an open, excisional procedures (i.e., facelift, neck lift, abdominoplasty). Concerns raised include increased difficulty in dissecting flaps and more importantly, the risk of vasculature compromise of the widely undermined flaps in the face or the body that may require pre/post-operative hyperbaric oxygen to mitigate the risk of necrosis. This case study the lead author’s extensive experience on RFAL and external Morpheus8 [8], treatments in patients who then subsequently presented after a year for excisional surgery. We retrospectively analyze the incidence of necrosis or vascular compromise of these flaps to determine if there is truly significant risk to patients who are initially treated with RFAL and RF modalities.

CASE PRESENTATION

Between 2008 and 2021, the lead author performed over 1,000 BodyTite (InMode, Lake Forest, CA) procedures on truncal and extremity areas. All patients have been female with an age range from 38 to 62 years old. Informed consent was obtained from all patients. The average time interval between RF treatment and a subsequent excisional procedure was 1.6 years.

In this case presentation, a cohort of patients went on to have excisional procedures of the torso and/or limbs after RF treatment. This included 30 abdominoplasties, 8 brachioplasties, and 4 anterior inner thigh lifts. A chart case was performed on these patients for evidence of delayed healing, complications, and more specifically, flap necrosis. Of the 42 excisional body flaps that were performed followed BodyTite (InMode, Lake Forest, CA) RFAL, 11 patients underwent secondary liposuction procedures performed after the excision. There was no incidence of necrosis or delayed healing. There were two cases of cellulitis, both periumbilical that resolved after a course of oral antibiotics. Neither patient was septic and was successfully treated on an outpatient basis. They did not require Intravenous antibiotics, drainage, or hospitalization. The case presentation also included a separate cohort of patients that underwent excisional procedures of the face and/or neck following FaceTite, AccuTite and/or Morpheus8 (InMode, Lake

Forest, CA). There were 600 FaceTite, AccuTite procedures performed between 2014 and 2021 on 105 female patients and 6 male patients (total n=111 patients). 75 patients underwent a facelift, 36 had a facelift and neck lift and 62 patients had blepharoplasty procedures. Critical examination of patient charts and photographs of the 111 flaps showed no cases of necrosis or delayed healing. There was one hematoma in the neck, and two depressor labii inferioris temporary neuropraxias that resolved by the 3-month follow-up visit without intervention.

Case 1

In 2014, this 66-year-old female underwent an endoscopic browlift and endoscopic midface-lift in addition to FaceTite RFAL to the submentum, anterior and lateral neck with 8 cc of aspirated fat. 4KJ of RF were emitted from the facelift on the jowl and neck, with a stamping and moving technique, 2 levels of RF treatment using cut-off parameters of 40 degrees external and 70 degrees. External fractional RF remodelling and resurfacing was performed using the Fractora 3000 micron coated with 800 pulses and 2 passes at 50 mj/pi performed on the neck after the FaceTite RFAL procedure. In 2018, the patient wanted to further improve the contour of her neck and thus underwent an open necklift through a submental and posterior auricular incision. This combined anterior and lateral approach allowed for complete subplatysmal and subcutaneous flap undermining. The platysma was divided transversely across at the inferior third of the neck and a hyoid suspension performed followed by a plication platysmaplasty. The patient at 12 months followed her Necklift after healing uneventfully and without any complications. Of note, there were no flap related vascular compromise or issues with delayed wound healing (Figure 1).



Figure 1: A 66-year old female that underwent RFAL to the submentum, neck and jowls. Four years later had an open necklift and facelift without complications or vascular compromise to the skin flaps. Pre-treatment in 2014 (left), one year after RFAL treatment (middle) and 1 year after facelift/necklift procedure in 2020 (right).

Case 2

In 2015, the 55-year old patient underwent RFAL to the abdomen, hips, flanks and bra-line. Parameters included cut-off temperature of 40 degrees external and 70 degrees internal using a stamp and move technique at 3 levels, 6 cm, 4 cm and 2 cm. 45 KJ of energy were deposited in the abdomen, and 8 KJ on each hip. Aspiration was performed after RFAL and thermal contraction (Figure 2a).

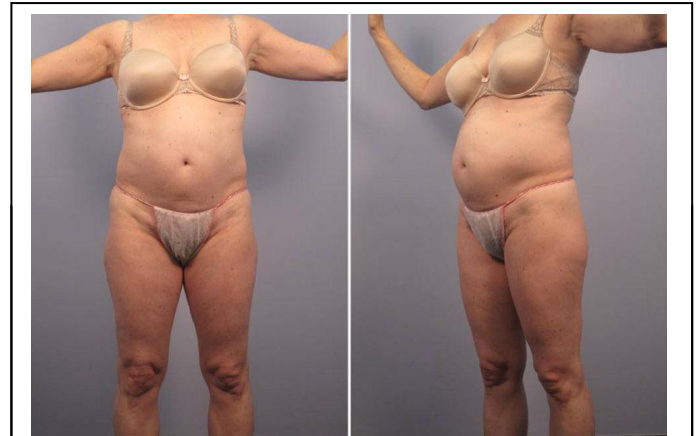


Figure 2a: A 55-year old patient underwent RAFL to the abdomen, hips, flanks and bra-line. 5 years later she had an abdominoplasty. There was no vascular compromise or complication to the abdominal flap despite undermining the entire abdominal wall. Pre-treatment frontal (left) and frontal oblique (right) of the patient.

In 2020, the patient underwent a low transverse suprapubic, skin-only abdominoplasty with complete undermining to the xiphoid. Dissection was performed widely to each costal margin but around the umbilicus without a transposition umbilicoplasty. The patient healed well with no vascular or flap related complication (Figure 2b).



Figure 2b: Pre-treatment images of the patient (left) in 2015, prior to RFAL. 1-year after abdominoplasty in 2020 (right). She recovered without complication, vascular compromise to the skin flap or delayed wound healing.

RESULTS AND DISCUSSION

The author's clinical observation and experience, supported by this case study, affirms that performing RF procedures (i.e., BodyTite, FaceTite, AccuTite and Morpheus8) one or more

years prior to an excisional procedure may create a fibrotic plane in the subcutaneous space that needs to be navigated much like a secondary face-lift. However, the dissection is not particularly difficult and can be safely performed without vascular compromise to the elevated flaps. There were no cases of vascular compromise and it is the senior surgeon's belief that the administrations of internal RFAL procedures may even create a delay phenomenon due to the necessity of performing a certain amount of discontinuous "undermining" prior to bipolar RF. Also, the amount of energy delivered for coagulative necrosis and ablative index by the bipolar RF devices is not sufficient enough to damage medium caliber perforator vessels one encounters during the dissection of a facelift/necklift. The perforators of the rectus abdominus and proximal limbs (arms/thighs) are even larger in caliber, thus, even less likely to be compromised with these minimally invasive treatments. Case study of the literature also supports the improved vascular supply (angiogenesis) and improved lymphatic flow that may occur after RFAL treatments [11]. These observed phenomena, coupled with the undermining performed during the index treatment may actually augment the perfusion of flaps and be protective for subsequent excisional surgical procedures. Further investigation is warranted to determine if there is a clinically significant vascular augmentation after these treatments.

CONCLUSION

In conclusion, this retrospective, single surgeon experience demonstrates that excisional procedures can be performed subsequent to internal/external RF treatments with a favorable safety profile. This analysis includes a large sample size from an experienced RFAL surgeon. It appears that the administration of precisely controlled bipolar RF thermal energy to temperatures of 40 degrees Celsius external and 70 degrees Celsius internal creates a subcutaneous plane of fibrosis that will be encountered during excisional procedures, but, this is no more difficult than a secondary procedure after primary surgery (i.e., facelift, neck lift, etc.). One of the known benefits of revision surgery is that there may be an enhanced blood supply due to the delay phenomenon. It is the conclusion of the author that patients should not be required to undergo preoperative hyperbaric oxygen or other prophylactic maneuvers in the absence of physiologic conditions such as autoimmune disease,

diabetes or active smoking status. A history of controlled RF energy-based treatments with BodyTite, FaceTite, AccuTite or the Morpheus (InMode, Lake Forest, CA) is not a relative contraindication to subsequent excisional surgery.

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