



From the SAFE to the SAFEST Liposuction: Combining PAL and RFAL Technology in Body Contouring Procedures

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Abstract

Background The SAFE liposuction technique is a worldwide extended method used to achieve great and reproducible results after the surgical aspiration of fat. We propose an evolution of the technique to address one of the major limitations of liposuction, loose skin. The SAFEST liposuction technique combines PAL and RFAL to achieve skin tightening and fat reduction with minimal added morbidity.

Methods Patients treated with the SAFEST liposuction technique between December 2019 and February 2022 were included in the study. Demographic and surgical data were collected retrospectively. Photographs and satisfaction interviews were conducted preoperatively and 12 months postoperatively in every case.

Results Sixty-five patients (58 female and 7 male) were included in the cohort, and a total of 169 anatomical areas were treated with the SAFEST liposuction technique (abdomen, arms, back, flanks and thighs). Globally, satisfaction at 12 months follow-up was of 94.1% and complications only presented in 4.7% of the treated areas. 6 of the 38 treated abdomens (18.4%) presented a complication (4 seromas and 2 access point infections) and 2 of the 38 treated flanks (5.3%) presented one (2 seromas). The rest of the treated anatomical areas (arms, back and thighs) showed no complications and high satisfaction rates.

Conclusions The SAFEST liposuction technique achieves outstanding and satisfying results with minimal complications by safely combining the advantages of two different technologies, PAL and RFAL. The main advantages of the presented technique are the skin tightening, the body ligament contraction, the coagulation and the reduction of the operative time.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords RFAL · PAL · SAFE lipo · SAFEST lipo

Introduction

One of the most common esthetic procedures is liposuction, which is defined as the surgical aspiration of fat in order to improve body contour [1, 2]. Advances in both technology and techniques have been made to increase safety, minimize complications and achieve better esthetic results [1, 3]. Based on their mechanism of action, these technologies are divided into groups: suction-assisted liposuction (SAL), ultrasound-assisted liposuction (UAL), laser-assisted liposuction (LAL), water-assisted liposuction (WAL), power-assisted liposuction (PAL), and, the recently introduced, radiofrequency-assisted liposuction (RFAL) [4, 5].

As technology advanced, so did the techniques. The SAFE liposuction technique, proposed by Wall, looks to improve liposuction results by preventing skin irregularities and contour deformities with minimal tissue injury [2]. The SAFE acronym stands for separation, aspiration and

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fat equalization, all of which describe the three-step process to achieve better esthetic results decreasing complications [2]. Despite the advances in the process, loose skin management remains an undesirable outcome. Abdominoplasty and other excisional surgeries target this setback but at the cost of scars and greater morbidity [6–8]. Therefore, a combination of the advances in technology and techniques might maximize skin retraction allowing for a practical solution to the problem.

The SAFEST liposuction technique adds skin tightening procedures to the approach described by Wall [2], thus improving results and targeting one of the major limitations of liposuction. As far as we know, the combination of the SAFE liposuction technique with RFAL to achieve better outcomes has never been described. The use of PAL during the SAFE liposuction technique adds speed, economy of motion, effectiveness in fat removal, and reduced operator fatigue to the procedure by applying a variable speed motor to provide reciprocating motion to the cannula [1, 9, 10]. RFAL combines liposuction with the destructive energies of radiofrequency to increase the contraction of the skin and subcutaneous tissue [5]. The combination of PAL and RFAL has proven to achieve the previously stated goals in a single procedure [11].

In this article, we describe our experience combining the SAFE liposuction technique with the use of PAL and RFAL to achieve both a significant tightening effect and a fat reduction with minimal added morbidity.

Methods

Between December of 2019 and February of 2022, all consecutive patients treated with the SAFEST liposuction by a single surgeon (J.O-M) were included in the study. Patient selection was limited to those patients with stable weight, body mass index $<30 \text{ kg/m}^2$, with no history of massive weight loss (for example post bariatric patients) and 18 years of age or older. Significant systemic illness, previous surgery of the area to be treated, pregnancy and psychiatric history were considered as exclusion criteria.

In all patients, sex, age at surgery, type of anesthesia, treated areas, lipoaspirate volume, radiofrequency parameters and complications were registered. Standard photographs and satisfaction interviews were conducted preoperatively and postoperatively in every case. For satisfaction evaluation, patients were assessed in our clinic 12 months after the procedure by the following two questions: “Are you satisfied with the result?” and “Would you recommend this procedure?” Only when patients answered affirmatively to both questions was the result considered satisfactory. All patients signed an informed consent preoperatively.

Surgical Technique

Patients were marked in a standing position in the preoperative area according to the area of treatment: abdomen, arms, thighs and banana roll. The predicted volume of fat extraction was the main criteria for the use of general anesthesia, local anesthesia with sedation, out-patient or in-patient procedure.

Separation (S)

The first step includes both infiltration and separation of the fat with a 3mm basket-tip cannula using PAL technology (MicroAire Surgical Instruments). Access ports are used to avoid skin damaging around the entry incisions. Infiltration in a 1:1 ratio between estimated aspirate and wetting solution is performed at least 10 minutes before suctioning. This step has three main goals: numbness of the area to be treated, effective vasoconstriction of the region and an initial fat separation and emulsification. Both superficial and deep fat are separated by the reciprocating motion of the cannula with no suction, therefore minimizing tissue injury and complications [2].

Aspiration (A)

Once the fat is separated, aspiration takes place. On average, we use a 4 mm Mercedes-tip cannula powered by PAL, moving it in a slow back and forth motion with minimum resistance [2, 9]. First treating the deep fat compartments and later, in patients looking for high-definition liposculpture (HDL), treating the superficial fat compartments following the preoperative markings.

Fat Equalization (FE)

The last step of the method described by Wall is the fat equalization [2]. In our technique, we used the PAL device with a 3 mm exploded-tip cannula. When needed, repositioning of the fat with the device and external manual pressure was done. The endpoint of this step is an even distribution of the remaining fat and smooth transitions between treated areas and contiguous regions.

Skin Tightening (ST)

This step includes the use of the RFAL device (Bodytite, Inmode) and the radiofrequency micro-needling instrument (Morpheus, Inmode). The former allows for subdermal heating and contraction with the use of radiofrequency (RF) energy generated between the two electrodes of the handpiece [5, 12]. The current provides controlled heating of the subcutaneous tissue and coagulation of the adipose

tissue. The internal electrode is introduced through the same incisions used for the previous steps. For safety, each electrode continuously measures the temperature of the external skin and internal fat, respectively. The measured temperature should not exceed 38°C on the external sensor and 65°C on the internal one. In case a one sensor handpiece is used, the external temperature should not exceed 38°C and the power applied should be of 60W.

The use of sterile lubricant is of vital importance in this moment to avoid burns and ensure better RF conductivity and smoother movement. It is important to modify the typical fanning motion of conventional liposuction to avoid thermal injuries in overtreated areas, especially surrounding the access points.

The amount of energy applied was conditioned by the area being treated, approximately 10-15Kj for every 1% of treated body surface. In our experience, 10-15Kj for every 1% of treated surface is equivalent to 65°C internally. Depending on the handpiece being used, different endpoints are considered. Our group employs one sensor handpieces; therefore, the goal is to apply 10-15kj. In patients where two sensor handpieces are used, the endpoint is to achieve an internal temperature of 65°C.

Once the desired energy was applied, exhaustive cleaning of the skin took place to ensure optimum conditions for the Morpheus8 treatment. The handpiece is applied perpendicular to the skin on burst mode with a 6mm depth and moved to the contiguous area with a 50% overlap until the whole area is treated, the power applied is of 30W. The micro-needling with heat at controlled depths induce dermal collagen formation and skin retraction [12–15].

Postoperative Care

Postoperative cares are similar to those of the classical liposuction in which pressure garments are applied and left for at least five days. Physiotherapy starts immediately after the procedure is done to enhance physical and functional recovery, and decrease complications [16, 17]. The application of intraoperative bandaging techniques below the compression garments immediately after surgery followed by manual lymphatic drainage (MLD) of the area allows for a faster and better recovery [18]. Our protocols include 3 sessions of manual lymphatic drainage during the first postoperative week, subsequently two sessions each of the following two weeks. According to the patient's evolution, manual lymphatic drainage may be prolonged as much as needed.

Results

A total of 65 patients (58 female and 7 male) were treated with the SAFEST liposuction technique between December of 2019 and February of 2022. The total amount of anatomical areas treated ascended to 169 as showed in Table 1 (put here Table 1). The abdomen, arms, back, flanks, and the lateral and medial thighs were included among the treated areas.

In total, 38 abdomens were treated with an average of 1.2 liters of fat aspirated. A satisfactory result, according to the patient, was achieved in 94,7% of cases (put here Fig. 1). Regarding complications, 15,8% of the abdomen sample presented one, being seroma (4 cases) and access point infection (2 cases), the ones described (put here Fig. 2).

The flanks were the second anatomical area with more complications. Nonetheless, only 2 out of 38 treated flanks (5,3%) presented seroma. The area with the least satisfaction rate was the medial thighs, achieving a satisfaction rate of 77,7%. The rest of the anatomical areas treated (arms, back and thighs) showed no complications and high rates of satisfaction (put here Figs. 3, 4, 5 and 6)

Globally, satisfaction at the 12 months follow-up visit was of 94,1% and complications only presented in 4,7% of the treated areas (6 seromas and 2 access point infections).

Discussion

Managing loose skin after liposuction has always been challenging in body contouring procedures. Reason why new developments on liposuction should target this issue without increasing morbidity. Our technique, the SAFEST liposuction, adds to the traditional SAFE liposuction described by Wall [2] the use of skin tightening technology by the combination of PAL and RFAL in the same procedure.

The reduction of operative times with a more selective trauma on fat tissue is one of the benefits achieved by the use of PAL [19, 20]. PAL is performed with an external power source that adds speed to the procedure and reduces the surgeon's fatigue, which translates in a higher efficiency and a safer and reproducible technique [21]. Our technique decreases operative times when compared to the use of RFAL without PAL.

On the other hand, RFAL technology generates controlled heat that affects both the skin and subdermal fat, which translates into dermal warming, skin and ligaments tightening, thermal lipolysis and blood vessel coagulation. These four action mechanisms limit patient swelling,

Table 1 Volume of lipoaspirate, satisfaction and complications by anatomical area

Anatomical area	Numer of areas	Lipoaspirate average, liters (range)	Satisfaction	% Satisfaction	Complication	% Complication
Abdomen	38	1.2 (0.6–2.5)	36	94,7	Seroma (4) Access point infection (2)	15,80
Arms	32	0.34 (0.2–0.7)	28	87,5	None	0
Back	17	0.46 (0.2–0.9)	17	100	None	0
Flanks	38	1.67 (0.8–2.5)	38	100	Seroma (2)	5,30
Lateral thighs	26	0.53 (0.3–1.1)	26	100	None	0
Medial thighs	18	0.39 (0.2–0.8)	14	77,7	None	0
TOTAL	169		159	94,1	8	4,70

bruising and discomfort and improve skin regeneration [22, 23].

The skin tightening effect requires special mention. It is mainly produced by the heating of the fibro-septal network (FSN), which leads to dermal contraction [24]. The FSN may be damaged with the use of some body contouring techniques limiting the use of RFAL for skin contraction. Such is the case of the Expansion Vibration Lipofilling (EVL) [25]. In our technique, we theorize that the FSN remains intact due to the fact that no tissue and cavity expansion takes place and no damage of the network occurs with the SAFE technique. Even though the latter appears to disrupt this structure, by following the steps of the technique, tissue preservation is maximized [2]. Hence, the effects of applying RF over the FSN are preserved.

The tightening effects of RF have been applied in many surgical fields, such is the case of orthopedic surgery in which joint instability treatment with RF has shown promising results by contracting corporal ligaments [26–28]. This ligament contraction may be generalized all over the body. A clear example is its application to the abdomen where RFAL may tighten the supraumbilical *linea alba* and elongate in a vertical manner horizontalized belly buttons (put here Fig. 7). Our group has demonstrated the efficacy of this tightening power to the cervicofacial area. The MICRO-lift technique describes how, by redistributing fat compartments and tightening cervicofacial ligaments with RF, face and neck rejuvenation is possible with a minimally invasive approach [29].

Clinically relevant skin tightening in properly selected patients achieved with RFAL may avoid scars associated with excisional surgeries. Other energy-based liposuction modalities, such as the UAL, the LAL and J-Plasma, have been described to manage loose skin. However, the lack of evidence for skin retraction relegated them to the background [19, 30–34]. Comparison between skin tightening results has been studied among techniques being of great

importance the conclusions reached for RFAL. Duncan described that the mean skin surface area reduction of the areas treated with RFAL at 6 weeks posttreatment was of 28.5%, three times greater than when SAL was use on its own (10.3%). Moreover, the differences found were even greater at 1 year posttreatment (RFAL 34.5% vs SAL 8.3%) with RFAL results stable in time [35]. SAL has also been compare to LAL without observing significant differences [36]. When comparing UAL with SAL, a small but significant increment of skin retraction was described when using UAL (17% retraction with UAL vs 11% wit SAL) [37]. Taking these results into consideration, it seems RFAL provides the best outcomes regarding skin retraction.

The J-Plasma devices require a special mention due to the fact that the U.S. Food and Drug Administration (FDA) warns health care providers against its use since its safety and effectiveness have only been determined for skin retraction procedures in the neck and submental region [38].

On their own, PAL and RFAL produce great results with a high level of patient satisfaction (94.1%). When combined the limitations of the other are addressed and achieved results of higher quality. Nonetheless, the SAFEST liposuction technique has a series of possible complications that require mention. We portray as the “ABC” of complications those specifically related to the use of RF.

“A” stands for access points complications. Care should be taken when overlapping treated areas near the access points. High energy near the incisions may impair wound healing and lead to skin suffering. “B” stands for bone, extreme heating of bony ridges may produce skin burns. Last, “C” stands for convexities. Body convexities may produce an uneven distribution of the applied energy and, if not taken into consideration, the skin may be damaged by the tip of the device’s handpiece. All of the previously



Fig. 1 A 32-year-old woman before (A, C) and 1 year after performing the SAFEST liposuction technique in abdomen and flanks (B, D). A total of 3.7 liters was removed circumferentially

mentioned complications could be avoided with the use of our step by step process.

In our sample, most of the complications occurred near the early stages of the development of our technique. This could be explained by the fact that the technique's learning



Fig. 2 Access point burns in lower abdomen

with the use of drains. Access point infection was avoided with the use of entry ports to protect the skin and by avoidance of energy application at least 3 cm around the entry incisions.

The amount of energy application is also of great importance. Our technique, by combining PAL and RFAL, allows for the use of less energy to achieve outstanding results decreasing complications intrinsic to procedures in which RFAL is use on its own: impaired wound healing of access incisions, extreme heating of bony ridges, burns and skin damage.

Adjuvant therapies after surgery need a special mention due to the fact that they speed recovery and diminish

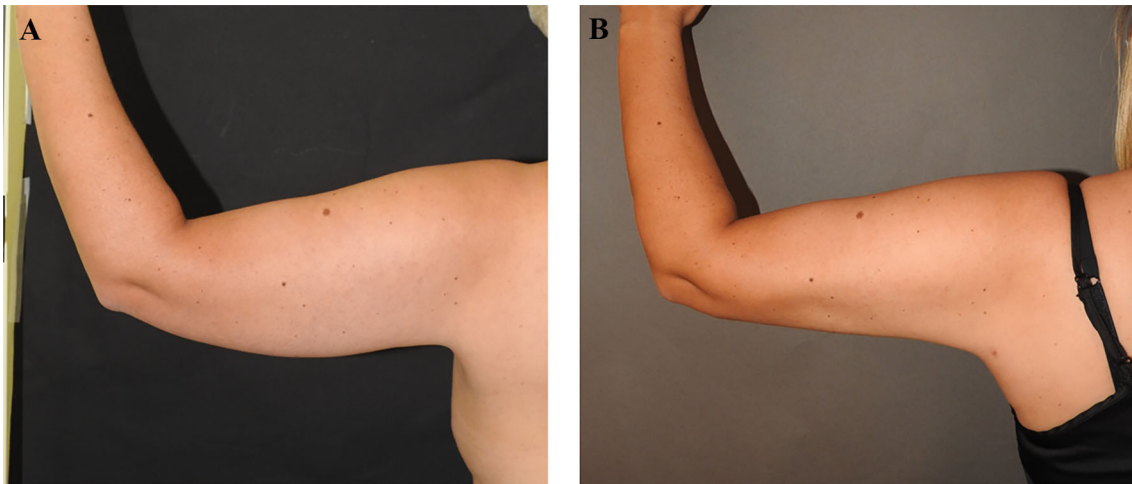


Fig. 3 A 47-year-old woman before (A) and 18 months after performing the SAFEST liposuction technique in arms (B). Note the reduction of the distance between the moles and the free edge of the arm

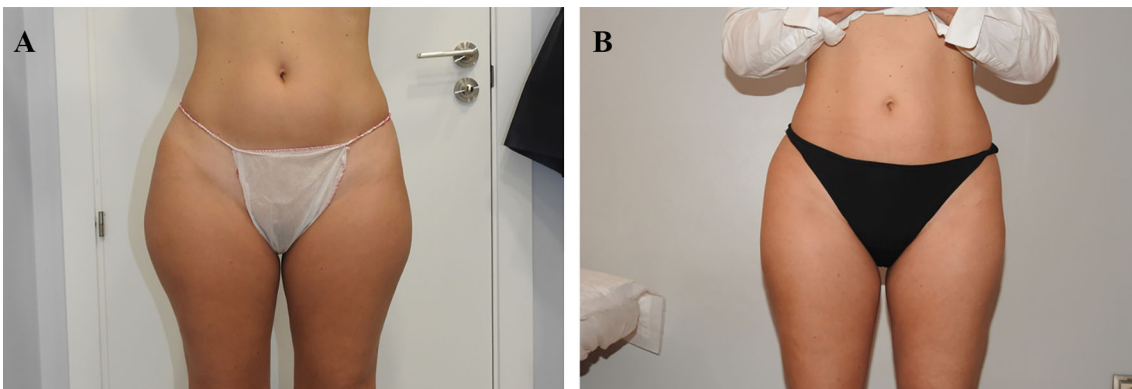


Fig. 4 A 52-year-old woman before (A) and 15 months after performing the SAFEST liposuction technique in medial and lateral thighs (B). A total of 2.4 liters of fat was removed

curve is small, and progress is achieved at a fast pace. Seroma rates appear to be slightly higher (4.7%) than previous RFAL publications [39]. Our technique is more aggressive because it adds fat equalization, explaining the minor rate increment. Nonetheless, seroma was avoided

patient's discomfort [18, 40]. Traditionally, MLD and compression garments have been used as decongestive measures during postoperative care. Recently, bandaging techniques, such as kinesiotaping, have gained popularity. MLD decreases accumulated fluid between interstitial



Fig. 5 A 42-year-old woman before (A) and 1 year after performing the SAFEST liposuction technique in the back and flanks (B). A total of 1.6 liters of fat was removed

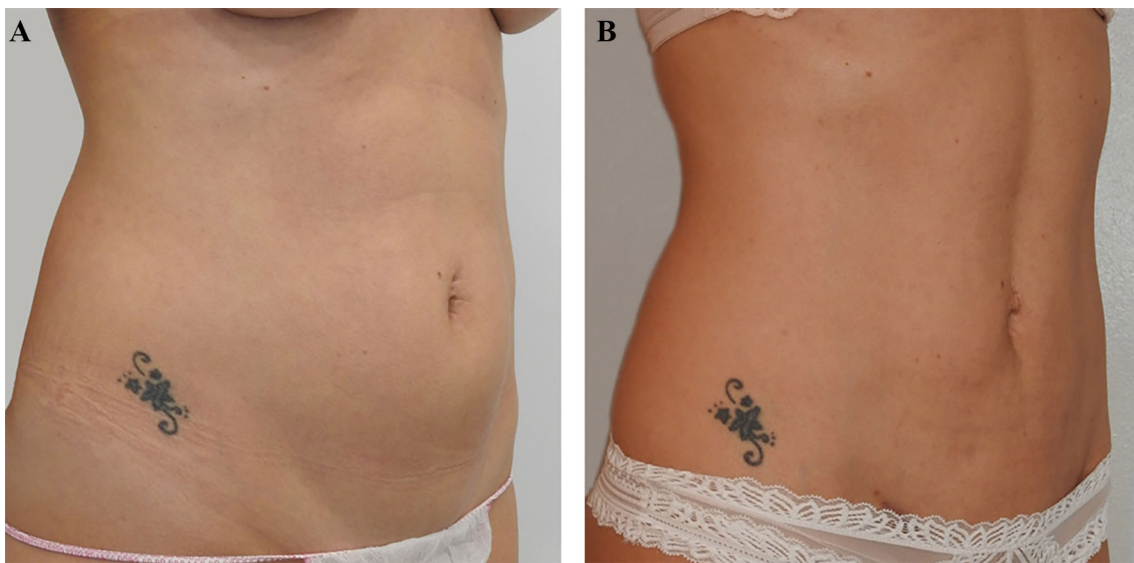


Fig. 6 A 46-year-old woman before (A) and 13 months after performing the SAFEST liposuction technique in the back and flanks (B). A total of 1.9 liters of fat was removed

spaces by using external pressure and manual manipulation to stimulate the lymphatic system. On the other hand, the use of kinesiotape treats edema by two mechanisms. The first by lifting the skin, improving lymphatic flow; the

second by a massage effect produced during active movement [17]. Our protocol combines each of the decongestive measures to assure a better outcome.

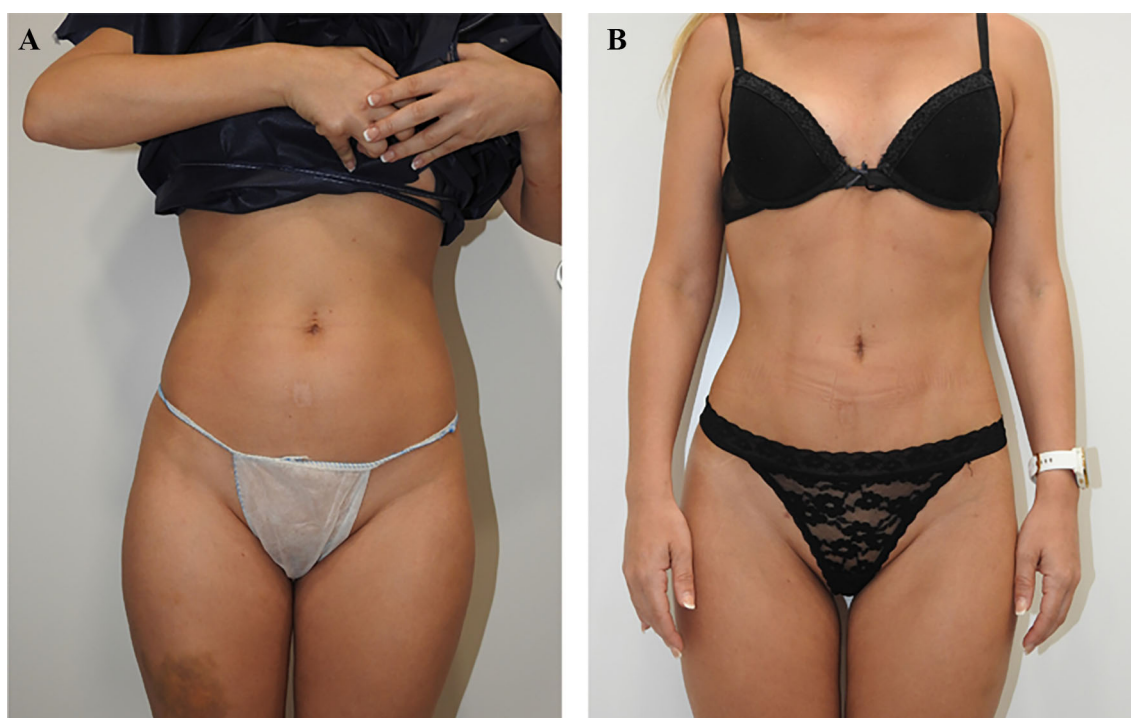


Fig. 7 Belly button reshaping before (A) and after tightening the supraumbilical *linea alba* (B)

The presented technique has several advantages that may be summarized as skin tightening, body ligament contraction, coagulation and reduction of the operative time by combining PAL and RFAL technology. Among the main limitations of our study, we must mention those that are inherent to technique description studies. Even though our sample is small and we focused in the treatment of specific anatomic regions, we believe our technique is promising, safe and reproducible. Future studies should consider comparison between different liposuction techniques to endorse our technique's advantages but current results are encouraging.

Conclusions

The SAFEST liposuction technique allows for the safe combination of the advantages of two different technologies, PAL and RFAL. The main advantages are the skin tightening, the body ligament contraction, the coagulation and the reduction of the operative time. We propose an evolution of the traditional worldwide extended SAFE liposuction technique achieving outstanding and satisfying results with minimal complications in hands of experienced surgeons.

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Declarations

Conflict of interest Dr. Jesus Olivas-Menayo is a consultant for Inmode Iberia. No payments or support were received for the publication of this study. Dr. Luis Chang-Azancot has nothing to disclose.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards."

Informed Consent All participants gave their informed consent in writing prior to inclusion in the study

References

1. Berry MG, Davies D (2011) Liposuction: a review of principles and techniques. *J Plast Reconstr Aesthet Surg* 64(8):985–992
2. Wall SH, Lee MR (2016) Separation, aspiration, and fat equalization: SAFE liposuction concepts for comprehensive body contouring. *Plast Reconstr Surg* 138(6):1192–1201
3. Ahmad J, Eaves FF, Rohrich RJ, Kenkel JM (2011) The American society for aesthetic plastic surgery (ASAPS) survey: current trends in liposuction. *Aesthet Surg J* 31(2):214–224
4. Saad AN, Pablo Arbelaez J, De Benito J (2020) High definition liposculpture in male patients using reciprocating power-assisted liposuction technology: techniques and results in a prospective study. *Aesthet Surg J* 40(3):299–307

5. Hurwitz D, Smith D (2012) Treatment of overweight patients by radiofrequency-assisted liposuction (RFAL) for aesthetic reshaping and skin tightening. *Aesthetic Plast Surg* 36(1):62–71
6. Lesko RP, Cheah MA, Sarmiento S, Cooney CM, Cooney DS (2020) Postoperative complications of panniculectomy and abdominoplasty: a retrospective review. *Ann Plast Surg* 85(3):285–289
7. Sirota M, Weiss A, Billig A, Hassidim A, Zaga J, Adler N (2021) Abdominoplasty complications—what additional risks do post-bariatric patients carry? *J Plast Reconstr Aesthet Surg* 74(12):3415–3420
8. Levesque AY, Daniels MA, Polynice A (2013) Outpatient lipoabdominoplasty: review of the literature and practical considerations for safe practice. *Aesthet Surg J* 33(7):1021–1029
9. Fodor P (2001) Power-assisted lipoplasty. *Aesthet Surg J* 21(1):90–92
10. Fodor PB, Vogt PA (1999) Power-assisted lipoplasty (PAL): a clinical pilot study comparing PAL to traditional lipoplasty (TL). *Aesthetic Plast Surg* 23(6):379–385
11. Theodorou SJ, Paresi RJ, Chia CT (2012) Radiofrequency-assisted liposuction device for body contouring: 97 patients under local anesthesia. *Aesthetic Plast Surg* 36(4):767–779
12. Dayan E, Chia C, Burns AJ, Theodorou S (2019) Adjustable depth fractional radiofrequency combined with bipolar radiofrequency: a minimally invasive combination treatment for skin laxity. *Aesthet Surg J* 39:S112–S119
13. Hantash BM, Ubeid AA, Chang H, Kafi R, Renton B (2009) Bipolar fractional radiofrequency treatment induces neoelastogenesis and neocollagenesis. *Lasers Surg Med* 41(1):1–9
14. Kaplan H, Kaplan L (2016) Combination of microneedle radiofrequency (RF), fractional RF skin resurfacing and multi-source non-ablative skin tightening for minimal-downtime, full-face skin rejuvenation. *J Cosmet Laser Ther* 18(8):438–441
15. Alster TS, Graham PM (2018) Microneedling: a review and practical guide. *Dermatol Surg* 44(3):397–404
16. Masson IFB, de Oliveira BDA, Machado AFP, Farcic TS, Júnior IE, Baldan CS (2014) Manual lymphatic drainage and therapeutic ultrasound in liposuction and lipoabdominoplasty post-operative period. *Indian J Plast Surg* 47(01):70–76
17. Hörmann J, Vach W, Jakob M, Seghers S, Saxer F (2020) Kinesiotaping for postoperative oedema—what is the evidence? A systematic review. *BMC Sports Sci Med Rehabil* 12(1):14
18. Kim YH, Cha SM, Naidu S, Hwang WJ (2011) Analysis of postoperative complications for superficial liposuction: a review of 2398 cases. *Plast Reconstr Surg* 127(2):863–71
19. Wu S, Coombs DM, Gurunian R (2020) Liposuction: concepts, safety, and techniques in body-contouring surgery. *Cleve Clin J Med* 87(6):367–375
20. Scuderi N, Paolini G, Grippaudo FR, Tenna S (2000) Comparative evaluation of traditional, ultrasonic, and pneumatic assisted lipoplasty: analysis of local and systemic effects, efficacy, and costs of these methods. *Aesthetic Plast Surg* 24(6):395–400
21. Abboud MH, Abboud NM, Dibo SA (2016) Brachioplasty by power-assisted liposuction and fat transfer: a novel approach that obviates skin excision. *Aesthet Surg J* 36(8):908–917
22. Blugerman G, Schavelzon D, Paul MD (2010) A safety and feasibility study of a novel radiofrequency-assisted liposuction technique. *Plast Reconstr Surg* 125(3):998–1006
23. Theodorou SJ, Del Vecchio D, Chia CT (2018) Soft tissue contraction in body contouring with radiofrequency-assisted liposuction: a treatment gap solution. *Aesthet Surg J* 38:S74–83
24. Chia CT, Neinstein RM, Theodorou SJ (2017) Evidence-based medicine: liposuction. *Plast Reconstr Surg* 139(1):267e–e274
25. Del Vecchio D, Wall S (2018) Expansion vibration lipofilling: a new technique in large-volume fat transplantation. *Plast Reconstr Surg* 141(5):639e–e649
26. Miniaci A, Codsí MJ (2006) Thermal capsulorrhaphy for the treatment of shoulder instability. *Am J Sports Med* 34(8):1356–1363
27. Miniaci A, Mcbirnie J (2003) Thermal capsular shrinkage for treatment of multidirectional instability of the shoulder. *J Bone Jt Surg Am* 85(12):2283–7
28. Carter TR, Bailie DS, Edinger S (2002) Radiofrequency electrothermal shrinkage of the anterior cruciate ligament. *Am J Sports Med* 30(2):221–226
29. Olivás-Menayo J (2022) The MICRO-Lift: a ligaments-based anatomic technique for lower face and neck rejuvenation using bipolar radiofrequency. *Aesthetic Plast Surg* 46(3):1211–1220
30. Blum CA, Sasser CGS, Kaplan JL (2013) Complications from laser-assisted liposuction performed by noncore practitioners. *Aesthetic Plast Surg* 37(5):869–875
31. Stephan PJ, Kenkel JM (2010) Updates and advances in liposuction. *Aesthet Surg J* 30(1):83–97
32. Collins PS, Moyer KE (2018) Evidence-based practice in liposuction. *Ann Plast Surg* 80(6S):S403–S405
33. Ibrahim SMS (2022) Aesthetic nonexcisional Arm contouring. *Aesthet Surg J* 42(7):63–73
34. Dayan E, Theodorou S (2022) Not all radiofrequency devices are created equal: a thermal assessment. *Plast Reconstr Surg Glob Open* 10(2):e4077
35. Irvine DD (2013) Nonexcisional tissue tightening: creating skin surface area reduction during abdominal liposuction by adding radiofrequency heating. *Aesthet Surg J* 33(8):1154–1166
36. Prado A, Andrades P, Danilla S, Leniz P, Castillo P, Gaete F (2006) A prospective, randomized, double-blind, controlled clinical trial comparing laser-assisted lipoplasty with suction-assisted lipoplasty. *Plast Reconstr Surg* 118(4):1032–1045
37. Nagy MW, Vanek PF (2012) A multicenter, prospective, randomized, single-blind, controlled clinical trial comparing VASER-assisted Lipoplasty and suction-assisted Lipoplasty. *Plast Reconstr Surg* 129(4):681e–e689
38. FDA (2022) Use of Renuvion/J-plasma device for certain aesthetic procedures: FDA safety communication [Internet, cited 2022 Sep 8]. Available from: <https://www.fda.gov/medical-devices/safety-communications/update-use-renuvionj-plasma-device-certain-aesthetic-procedures-fda-safety-communication>
39. Chia CT, Marte JA, Ulvila DD, Theodorou SJ (2020) Second generation radiofrequency body contouring device: safety and efficacy in 300 local anesthesia liposuction cases. *Plast Reconstr Surg Glob Open* 8(9):e3113
40. Allam NM, Elshorbagy RT, Eid MM, Abdelbasset WK, Elkholi SM, Eladl HM (2021) Comparison of extracorporeal shock wave therapy versus manual lymphatic drainage on cellulite after liposuction: a randomized clinical trial. *Evid Based Complem Alternat Med* 10:1–7

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