

Investigating the Role of Radiofrequency in Back Contouring after Massive Weight Loss

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Abstract

Background: The increasing prevalence of obesity and the high success rate of bariatric surgery have made the presentation of skin sagging and obesity on the back difficult. Several contouring techniques have been described for the treatment of such difficult deformities.

Objective: The aim of this study is to compare the aesthetic results of two energy-assisted liposuction techniques; Radiofrequency-assisted liposuction (RFAL) and VASER-assisted liposuction (VAL) in back contouring of patients with massive weight loss.

Patients and Methods: A total of 163 consecutive patients underwent surgery between January 2017 and January 2021.

106 patients (the study group-A) underwent RFAL (BodyTite RF platform, Invasix Corp.). Fifty-seven patients (the control group-B) underwent VAL (VASER-Lipo system; Sound Surgical Technologies, Louisville, Colo) alone without using the BodyTite RF platform.

Results: The mean age was 31.5 years. The mean follow-up time was 29 months (range: 12-60 months). The esthetic satisfaction in group A was rated as excellent by 48 patients (45.28%), good by 40 (37.74%), fair by 9 patients (8.49%), and poor by 9 patients (8.49%). In group B, 29.82% of patients had an excellent and good result, while 70.18% rated the result as average to poor due to the increase in excess skin. Early complications occurred in 8 patients (7.55%), including minor tip hits burn (6 cases), a mild burn, and a seroma without hematoma.

Conclusions: Radiofrequency-assisted liposuction provides a safe and effective treatment for back contouring after massive weight loss while avoiding more invasive surgical procedures.

Key Words: Back rolls – RFAL – VASER – Massive weight loss – Bra-line back lift.

Ethical Committee Approval: The present study follows the guidelines for good clinical practice and was approved by the Scientific Committee of the Alexandria school of Medicine, under serial number 0305726. Written informed consent was obtained from all patients for the studied technique and the use of photography.

Disclosure: No conflict of interest.

Introduction

Obesity is the epidemic of modern life, which has various medical and psychological consequences [1]. Many consider bariatric surgery a successful means of weight loss [2]. However, patients' concern about having multiple deformities due to excess skin negatively affects their social and intimate activities, leading to an increasing number of cosmetically dissatisfied patients seeking body contouring surgery due to multiple body contour deformities [3,4].

The development of multiple back rolls after massive weight loss is a challenge for plastic surgery. Traditionally, elimination of these back rolls often required surgical procedures such as belt lipectomy, bra line lift, and oblique flankplasty. Compared to liposuction, all of these procedures are extensive techniques, leaving long, obvious scars on the back and involving various complications such as hematomas, seromas, wound dehiscence, and neuropathy [5,6]. Patients often seek alternatives to surgical treatment, and it's important for plastic surgeons to be aware of these and what evidence supports alternatives other than excision for esthetic back contouring.

Many plastic surgeons document the appealing effects of radiofrequency as a powerful tool for skin tightening in various body areas. They noted that thermally stimulated soft tissue is associated with a reduction in surface area that improves over time through both immediate thermal and delayed inflammatory effects [7-11].

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Bailey et al., [12] identified the various fat compartments in cadaver preparation of the back. They enumerated 4 retaining ligaments on the back; parascapular, lumbo-thoracic, lumbar, and supra-iliac, each ligament represents a collagen condensation originating from the spinous process of the vertebra, within the ligament boundaries there are accumulations of very well defined deep fat deposits whose volume may increase with weight gain. The retaining ligaments form tether points that, if weight loss is successful, result in horizontal and vertical laxity, causing multiple cosmetically unattractive back folds. Based on the above study and the landmark article by Lockwood [13] on the fascial framework within the subcutaneous tissue, the rich interconnected fibrous network within the adipose tissue of the back can be tightened by the heat generated by the radiofrequency (RF) devices.

There are three rating scales that define back deformities; The Pittsburgh scale (6), the Iglesias et al scale (14), and the Thomas and Dsilva scale (15), all of these scales used subjective terms such as moderate obesity, good skin tone, loose skin, and moderate volume loss. The author found the Thomas and Dsilva scales to be a clinical classification that ranks the extent of back roll in a simple way that would help select the best possible course of treatment.

Objectives:

The study aims to compare the esthetic outcomes of two energy-assisted liposuction techniques; radiofrequency assisted liposuction RFA (Group A the study group) and VASER-assisted liposuction VAL (Group B the control group) in back contouring of MWLP.

Patients and Methods

This is a randomized controlled study for back contouring involving 163 cases from January 2017 to December 2021, 106 Subjects (Group A) underwent VAL followed by RFAL with the use of the BodyTite RF platform (Invasix Corp.) and 57 Subjects (Group B) received VAL alone as a control group.

The present study was conducted in accordance with the Good Clinical Practice Guidelines and Institutional review board approval was provided by faculty of Medicine, Alexandria University. (serial number 0305726), and the 1964 Declaration of Helsinki. Written informed consent was obtained from all patients for the technique and use of photographs.

Exclusion criteria include patients with BMI greater than 35, patients with unstable weight (weight change >20% in the last six months), and patients with severe skin laxity on the back (severe stria indicating loss of skin elasticity) with the highest prospects. Fig. (1).

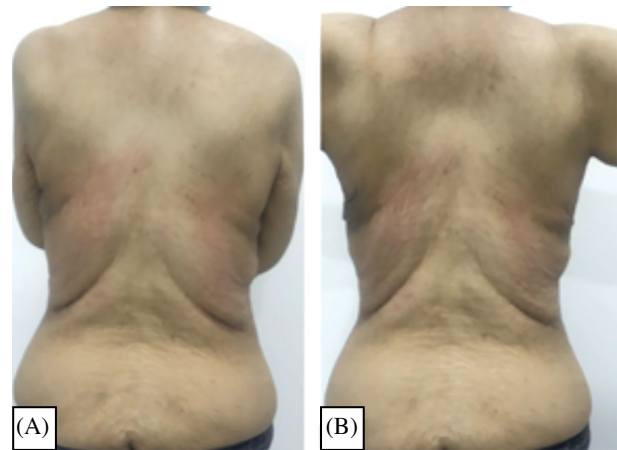


Fig. (1): A 24-year-old female presented with excessive fat, severe skin redundancy, leading to the formation of multiple back rolls and extensive skin stria denoting loss of skin elasticity. The back rolls position does not change with elevation of the arms above the head because of the heavy dorsal pannus. This case represents absolute contraindication for RFAL contouring of the back.

Pre-operative assessment:

The physical examination was performed in the standing position, with the patient's arms lowered at the sides, abducted at 90°, and raised above the head. Skin quality was documented in terms of the skin thickness, amount of stria, volume of subcutaneous fat, and Fitzpatrick skin type.

After a detailed consultation regarding the technique and possible surgical alternatives, complications, and expected outcome, written informed consent was obtained, with the simple explanation that the technique was not an alternative to surgical back lift, and a clear indication of the possibility of a redo or even surgical revision (back lift) after one year.

Standard photographs were used to document the overall condition of the back; a posterior view with the patient's arms at the sides, abducted at 90°, and elevated above the head, and a right lateral, left lateral, and oblique view.

All suction sites (back rolls, waist, iliac crest, and flanks) were marked in the standing position. Marking also included areas for gluteal lipotransfer at the patient's request. Fig. (2).



Fig. (2): Pre-operative marking showed the 4 dorsal rolls: parascapular, lumbo-thoracic, lumbar, and supra-iliac folds, in addition of the sacral promontory (SP). The circles denote the access points.

Surgical technique:

All patients underwent surgery under general anesthesia. Position: Prone with arms moderately abducted on the adjustable arm boards with elbows flexed. The back was prepared and draped in a sterile fashion. The upper third of both arms was included in the draping area.

A total of 4-6 small stab incisions were made to gain access to the deep and superficial compartments of the back and flanks. 2-3 vertical midline incisions served as access points at the level of the division between the dorsal rolls; one was at the bra line, the second just above the gluteal cleft, and sometimes a third midline incision was made midway between the above mention incisions to empty a prominent lower scapular roll.

Tumescent fluid was infiltrated at a super-wet ratio of 1:1 to reduce operative blood loss without distorting the contour of the treated tissue.

Fat was emulsified with the VASER (VASER lipo System; Sound Surgical Technologies, Louisville, Colo), using a 3.7-mm solid probe with 3 grooves at 70% total power in V mode to avoid exposing the skin to excessive heat energy. The duration of cavitation was nearly 1min for each 150ml infiltration.

Liposuction was done prior to RFAL heating, this reduces the insulating adipose tissue and allow more exposure of the FSN to the heating of RFAL.

A 4-mm Mercedes cannula was used for removal of deep fat, followed by a smaller 3-mm Pinto cannula for superficial thinning, using a crisscross pattern to minimize the potential for contour irregularities. Release of the adhesion zone is a very

important step in the technique because it allows for smooth skin recruitment over the waist, which optimizes the final shape.

The lateral regions (love handles) were accessed by 2 transverse lateral incisions at the level of the iliac crest. Later, these two incisions were used for drain placement. Fat over the sacral promontory was removed with a 15cm long cannula. Fat in the axilla and the crescent-shaped area around the shoulder were removed via upper lateral incision.

Group A:

RFAL parameters were set with a cutoff temperature of 38°C and a power of 38 watts. The depth wheel was set at 3-4 cm, which does not correspond to the thickness of subcutaneous tissue but reflects the length of subcutaneous fibers remaining after evacuation of subcutaneous fat. A sterile ultrasound gel mixed with saline was used to cover all treated areas to improve the mobility of the device and reduce the impedance between the two RF electrodes. The back was divided into 4 quadrants, the amount of energy delivered to each quadrant was set at 20 kilojoules -kJ- (each 20 KJ was divided into 10 KJ with the knob set at 3cm, another 10 KJ with the knob set at 4cm. The goal was to treat the long subcutaneous fibers at multiple levels rather than concentrating the energy at one level. Video (1).



video1.mov

Moving the electrode in the deeper tissues is slow and laborious to help reattach the flaccid pannus (a common drawback with MWLP) to the deep fascia, but shifting to deliver heat gently and evenly through rapid movements in the superficial planes to protect the skin from the risk of thermal injury. Video (2).



video 2.mov

The esthetic results were noticeable from the first moment, as the contours were visibly flattened.

Group B:

Patients in this group were treated with VAL alone, using the same technique of blunt dissection to free the subcutaneous ligaments but without the help of the energy-generating device mentioned in the study.

A gluteal lipo-transfer was performed to achieve maximum projection of the buttocks in some female patients.

A closed suction drain was placed on the lower back, while the other upper incisions were left open at the end of the procedure.



Fig. (3): Patient's intra-operative prone position with the drain in place.

At the end of the procedure, the following data were collected for each patient: Age, gender, height, weight, body mass index (BMI), delta BMI (change from maximum BMI to current operating BMI), total amount of fat aspirate, and total amount of fat graft in case of buttock augmentation.

Post-operative care:

Patients received oral antibiotics for a week postoperatively to prevent possible infection associated with drain placement. Patients were instructed to empty the drains regularly. Drains remained in place until drainage was less than 30mL in 24 hours.

Epi-Foam compression foam pads (Biodermis, NY) were placed under the compression garment at the level of the bra lines for two weeks. The compression garment was used alone for an additional four weeks.

Post treatment assessment:

Patients were seen and photographed at 3 months, 6 months, and 1 year postoperatively.

Two questionnaires were used to evaluate postoperative outcomes 12 months postoperatively: The patients and independent plastic surgeon. Each patients rated the following parameters: volume of skin retraction, reduction of the back rolls, definition of the back, residual skin folds, and complications. The esthetic outcomes were classified using a 4-point scale: 1 = Poor, 2 = Average, 3 = Good, and 4 = Excellent. An independent plastic surgeon evaluated the esthetic outcome using the same 4-point scale to assess the improvement in back contour, using anonymous images of the patients studied who had completed the treatment. These images were then presented in a PowerPoint presentation in random order, with no indication of treatment modality. The left half of the slide was the patient's preoperative back view. The right half of the slide was at least 6 months postoperative or longer with the same views. In this way, one slide showed both the before and after condition of the back.

Results

163 patients were operated upon from 2017–2021, of these 131 (80.37%) were female patients, and 32 (19.63%) were male patients. Follow-up time ranged from 12 to 60 months and a mean of 29 months. The average age was 31.5 years, which was similar in both groups.

The preoperative BMI of the patients ranged between 20.4 and 34.7kg/m², with a mean of 29.45 kg/m². Before massive weight loss, all patients were morbidly obese with a mean BMI of 42.29kg/m². 87.73 % of the formerly morbidly obese patients in the study failed to achieve a "normal" BMI (<25 kg/m²) regardless of age or gender.

The amount of suctioned fat ranged from 200 to 4600ml (mean, 2400ml).

The mean operative time was longer in Group A (1 hour, 40min) than in Group B (1 hour, 10 min) and the difference was statistically significant (*t*-test <0.05).

The cases in the study were classified according to the practical scale of Thomas and Dsilva [15].

Table (1): Demographic and clinical data of the studied and the control group.

	The study group 106	The control group 57
Total number patients		
Sex:		
Females	82 (77.36%)	49 (85.96%)
Males	24 (22.64%)	8 (14.04%)
Age (years):		
Minimum	19	21
Maximum	57	53
Mean	31.5	31.6
Age Groups (years) :		
<20	1 (0.94%)	0
20-30	31 (29.25%)	16 (28.07%)
31-40	52 (49.06%)	17 (29.82%)
41-50	17 (16.04%)	15 (26.32%)
51-60	5 (4.72%)	9 (15.79%)
Weight (kg):		
Minimum	43	49
Maximum	86	78
Mean	67.24	62.6
Weight Loss (kg):		
Minimum	37	34
Maximum	70	59
Mean	49	41
Bariatric surgery procedure:		
Sleeve gastrectomy	89 (83.96%)	44 (77.19%)
Gastric bypass	10 (9.43%)	7 (12.28%)
Gastric band	7 (6.6%)	6 (10.53%)
Morbid BMI:		
Minimum	39.7	37.9
Maximum	54.7	49.8
Mean	44.9	41.6
Operating BMI:		
Minimum	20.4	23.4
Maximum	34.7	33.7
Mean	29.8	27.4
BMI Group:		
<19	0	0
19-25	14 (13.2%)	6 (10.53%)
26-30	48 (45.28%)	30 (52.63%)
31-35	44 (41.5%)	21 (36.84%)
Follow-up (months):		
Minimum	13	12
Maximum	56	60
Mean	22	27
Active smokers	16	9
Liposuction volume (ml):		
Minimum	200	1100
Maximum	3600	4600
Mean	2440	3150

Table (2): Classifications of the back deformity of the studied patients according to Thomas and Dsilva's scale.

	Group A	Group B
I	0	0
II	19 (17.92%)	7 (12.28%)
III	48 (45.28%)	31 (54.39%)
IV	39 (36.79%)	19 (33.33%)
Total	106	57

Satisfaction rate:

Statistical analysis proved the superiority of RFAL in back contouring in group (A), as aesthetic satisfaction was rated as excellent by 48 patients (45.28%), good by 40 (37.74%) who were graded II & III, while 18 patients who were graded IV described the results as average in 9 patients (8.49%) and 9 patients (8.49%) as poor.

In the control group, 29.82% of patients had an excellent and good result (grade II) due to the strong effect of VASER in liposuction, while 70.18% of the control group had an average to poor result due to the increase in excess skin (grades III and IV).

Table (3): Post-operative esthetic results of the study and the control group.

	Patients' review			
	Excellent	Good	Average	Poor
Group (A)	48 (45.2%)	40 (37.74%)	9 (8.49%)	9 (8.49%)
	88 (83.02%) out of 106 cases		18 (16.98%) out of 106 cases	
Group (B)	9 (15.79%)	8 (14.04%)	15 (26.32%)	25 (43.6%)
	17 (29.82%) out of 57 cases		40 (70.18%) out of 57 cases	
	Surgical team review			
	Excellent	Good	Average	Poor
Group (A)	40 (37.74%)	39 (36.79%)	17 (16.04%)	10 (9.43%)
	79 (74.53%) out of 106 cases		27 (25.47%) out of 106 cases	
Group (B)	11 (19.3%)	12 (21.05%)	16 (28.07%)	18 (31.58%)
	23 (40.35%) out of 57 cases		34 (59.65%) out of 57 cases	

Complication rate:

The tip hit injury was the most common local complication caused by direct contact of the RFAL handpiece tip with the skin. It occurred in 6 cases in group A, which was due to the concave shape of the back (by default, the tip of the handpiece is directed toward the skin).

In group A, 2 cases suffered from partial thickness burn (5cm^2), possibly due to aggressive superficial liposuction in the adhesive zone.

No major general complications occurred in either group.

Table (4): Complication rate in both groups.

Complication	Group (A)	Group (B)
Tip hit injury	6 (5.66%)	0
Seroma	1 (0.94%)	3 (5.26%)
Minor burn	2 (1.88%)	4 (7%)
Hematoma	0	1 (1.75%)
Subcutaneous nodules	1 (0.94%)	0
Port hypertrophic scarring	4 (3.77%)	3 (5.26%)
Lower back lift (revision)	0	2 (3.5%)
Bra line lift (revision)	0	1 (1.75%)
Major burn (>5cm ²)	0	0
DVT	0	0
Total	14 (13.21%)	14 (24.56%)
	Out of 106 cases	Out of 57 cases

Figs. (4-8) demonstrate preoperative and post-operative images for back contouring using RFAL.

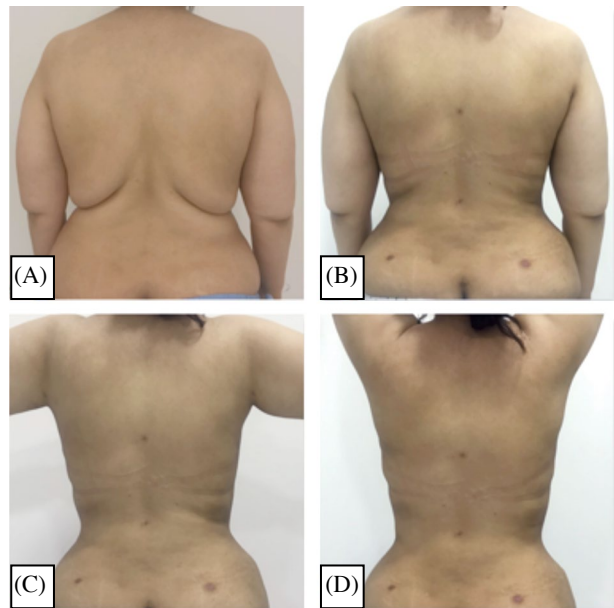


Fig. (4): A 37-year-old female, BMI; 31.2 presented.

(A): Preoperative posterior view of severe dorsal adiposity grade III after weight loss of 20kg after sleeve gastrectomy (morbid BMI=38.6).

(B-D): Posterior view of the back with the arm aside, abducted 90° & raised above the head, 12 months postoperatively, showing excellent result after liposuction of 2300cc aspirate, followed by 80 kJ RFAL at 38 watts, 38°C.

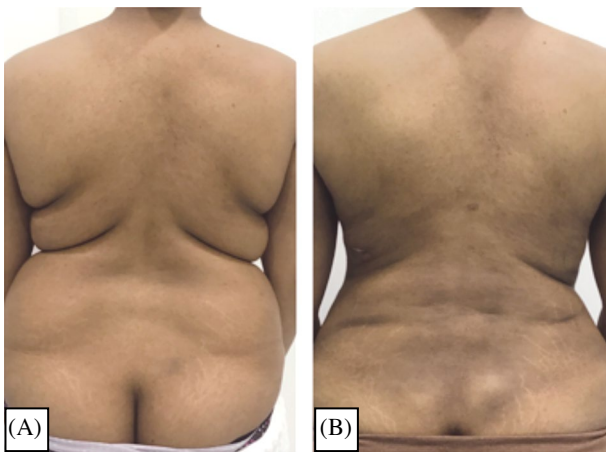


Fig. (5): A 32-year-old female, BMI; 30.9 presented.

(A): Preoperative posterior view of severe dorsal adiposity grade III after weight loss of 27 kg after sleeve gastrectomy (morbid BMI= 40.2).

(B): Posterior view of the back, 23 months postoperatively, showing good result after liposuction of 1700 cc aspirate, followed by 80 kJ RFAL at 38 watts, 38°C.

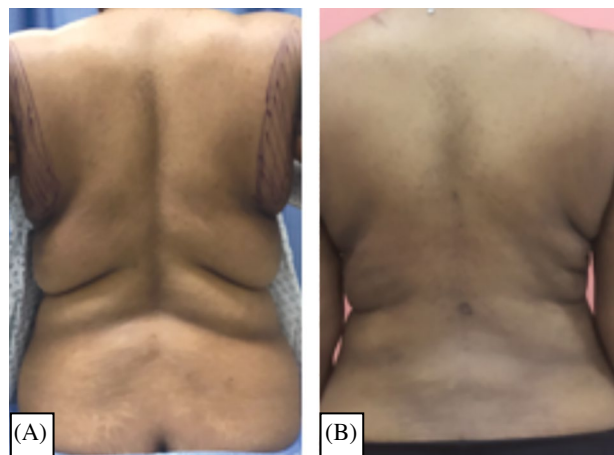


Fig. (6): A 32-year-old female, BMI; 31.2 presented.

(A): Preoperative posterior view of severe dorsal adiposity grade III after weight loss of 41kg after gastric band (morbid BMI= 49.1).

(B): Posterior view of the back, 12 months postoperatively, showing fair results (due to evident residual back roll) after liposuction of 3000 cc aspirate, followed by 80 kJ RFAL at 38 watts, 38°C.

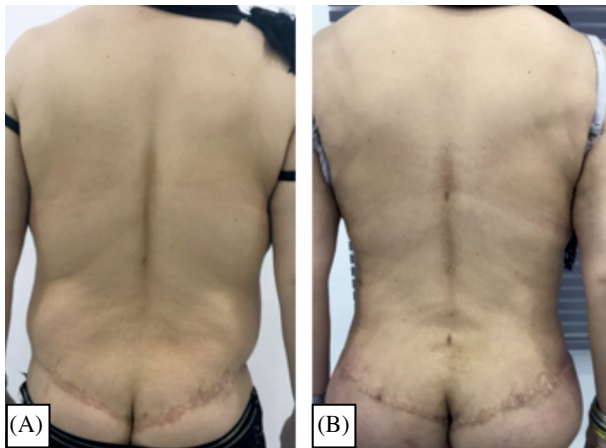


Fig. (7): A 42-year-old female, BMI; 27.5 after sleeve gastrectomy presented.

- (A): Preoperative posterior view of residual dorsal adiposity, oversized flanks, constricting and wide transverse scar with obvious flank bulge grade IV after unsuccessful lower back lift because of the loss of the feminine contour.
- (B): Posterior view of the back, 38 months postoperatively, showing excellent results after liposuction of 2000 cc aspirate, followed by 80 kJ RFAL at 38 watts, 38°C and submuscular buttock augmentation with silicone implant.

Discussion

Skin sagging and excess adipose tissue on the back is a common complaint of many patients after massive weight loss. Despite its high cost and absence of insurance coverage, body contouring surgery typically results in a high level of patient satisfaction [16].

Kenkel [17] defines the back roll after massive weight loss as loose skin overlapping through thin subcutaneous tissue transversely from the subdermis to the muscle fascia. Many plastic surgeons advise removing the rolls by either direct excision or superior excision, disentangling the roll, and suturing it to a superior anchor line [18-22]. Although excisional back lift is a powerful tool for contouring the mid and upper back, the complication rate and associated long noticeable back scar are a hindrance especially in dark-skinned individuals.

Correcting back rolls without surgical excision is the goal of every plastic surgeon, while traditional SAL has been reported to offer mild skin tightening, with the advent of new devices such as heat-generating machines, new options may be added to improve the esthetic results of back contouring in MWLP.

Duncan [9] reported linear skin contraction in abdomens at 6 months varying from 12.7 to 47% depending on the patient and treatment variables after thermal stimulation using RF has been com-

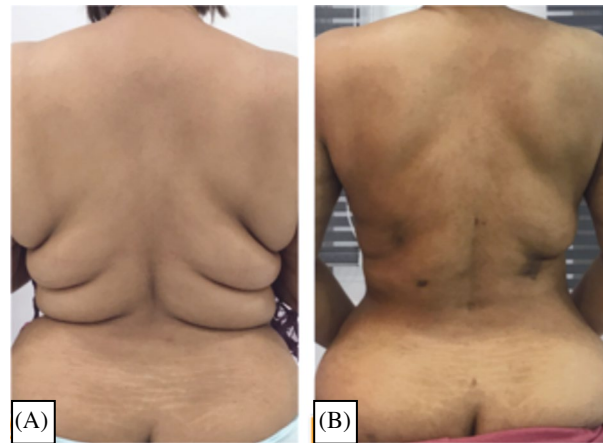


Fig. (8): A 34-year-old female, BMI; 33 presented.

- (A): Preoperative posterior view of severe dorsal adiposity and multiple back rolls grade III after weight loss of 56 kg after intestinal bypass (morbid BMI=48.3). The patient suffered a partial-thickness burn of the midback <5cm² after liposuction of 4100 cc aspirate, followed by 80 kJ RFAL at 38 watts, 38°C, the burn healed by secondary intention 17 days postoperatively.
- (B): Posterior view of the back, 41 months postoperatively, showing excellent result.

pared to 10.4% at 6 weeks, which decreased to 8.26% at 1 year with SAL alone. This is consistent with the study findings that RFAL is most valuable in moderately severe cases (grade 2 and 3 cases) where standard liposuction does not provide good results and back lifting leaves an obvious scar.

Recently, Guerrerosantos et al., [23] applied modified RF energy percutaneously for fat removal with simultaneous tightening of skin and fascia without affecting the viability of the overlying skin, calling this procedure percutaneous radiofrequency dermaplasty (PRD).

Despite the reported safety and success of RFAL in skin tightening in many body regions after MWLP, its role in contouring the back is underappreciated. The presenting study elaborates some clinical tips as a key to a safe and successful back contouring with RFAL: the direction of liposuction, the skin temperature setting, and the power of the device.

Direction of liposuction:

Some plastic surgeons [24-27] described the direction of liposuction parallel to the axis of the fat roll. In the present study, the direction of liposuction was both transverse and craniocaudal (criss-crossing). It is important to use the liposuction cannula to disrupt the zones of adherence by blunt undermining to allow complete mobilization of the dorsal skin. The idea is simple: To transform a convex surface (back rolls) into a concave surface

(waist line) by creating thin skin flap, while RFAL heats the fibrous tissue at the FSN and helps reattach this flap to the deep fascia.

The power of the machine: In the study, the adjusted temperature cutoff was 38°C as in Duncan [9], unlike Hurwitz and Smith [28] who stated that using a higher power and a skin temperature cutoff of 40-42°C for the deep layer is safe. The use of a high power in the deep layer may cause excessive contraction of the deep layers, resulting in surface irregularities and prolonged postoperative edema.

Duncan [9] reached the excellent clinical conclusion after abdominal contouring with RFAL that the medial treatment regions had a higher skin contraction rate than the lateral regions. She hypothesized that the more fat present in the central site, the more surface area reduction was noted. The same clinical finding was evident in the study: 88 (83.02%) patients were classified as high-volume patients, which is consistent with the work of other plastic surgeons that the warming effect of RF increases in high-volume patients, resulting in a better clinical effect. Again, this is a clinical observation and not a histologic finding [28,29].

Complication rate:

Complications following RFAL range from minor tip injuries to more serious complications related to thermal damage. Chia et al., reported an overall complication rate of 6.25%; 8.3% tip hits across all treatment areas, 5 seromas that required drainage in the office, and 3 second-degree burns in 97 cases [29,30].

The incidence of minor tip hits in the present study was 5.66% because the newer versions of RFAL devices have an insulated tip, in spite of that, there were 2 cases of superficial burn and healing occurred with secondary intension. My early experience in the study included 4 cases of seromas being drained in the office (one in group A and three in group B). This required routine drainage in all subsequent cases.

The strengths of the study are as follows:

The patients are a homogeneous group in terms of demographics and comorbidities, The study represents a novel effective minimally invasive technique for back contouring in selected cases in MWLP, the patient cohort is large, and the follow-up period is relatively long.

Conclusions:

Treatment of the back laxity and adiposity after massive weight loss must be tailored. There is no ideal method for all patient types. Some may be candidates for standard liposuction, others may benefit from the adjunctive effect of the heat-generating devices with RFAL, and some patient groups are candidates only for surgical lift.

Patients exhibit both significant skin laxity and moderate to major lipodystrophy (Thomas and Dsilva scales II&III) are good candidate to RFAL back contouring, because of the robust fibrous nature of the back helps in skin recruitment after the use of RF.

Patients exhibit only excess deflated skin with normal BMI (<25 kg/m²) after massive weight loss (high delta BMI patients) represent absolute contraindication of RFAL back contouring, they benefit only from the surgical back lift.

RFAL for back contouring after massive weight loss offers pleasing results to properly selected patients who have reasonable expectations. The technique is safe because it has monitored temperature control feedback (temperature cutoffs mechanism, temperature surge protection, and audible feedback).

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