JOURNAL OF PLASTIC SURGERY AND HAND SURGERY
2022, VOL. 56, NO. 6, 387–395
https://doi.org/10.1080/2000656X.2022.2061500

ARTICLE

Puboplasty as an integral step in massive weight loss abdominal contouring: a retrospective assessment of results, stability, and patients' satisfaction

Pierfranco Simone[a], Luca Savani[a], Paolo Marchica[b] and Paolo Persichetti[a]

[a]Department of Plastic, Reconstructive and Aesthetic Surgery, Campus Bio-Medico of Rome University, Rome, Italy; [b]Clinic of Plastic Surgery, Department of Neuroscience, Padua University Hospital, Padua, Italy

ABSTRACT

Ex-obese patients complain about abdomen and pubis deformities following massive weight loss, due to skin and soft tissue redundancy. Abdominoplasty is often the first corrective procedure performed, but residual mons pubis deformities may impair the final outcome, thus concomitant correction becomes necessary. Sixty patients were treated by the same surgeon between 2008 and 2018, 30 of them receiving only standard umbilical transposition abdominoplasty (A group), and 30 having concurrent monsplasty (AM group), namely skin excess removal, pubic suspension and skin redistribution following superolateral vectors, re-establishment of superficial fascia continuity, with or without liposuction. Retrospective comparison of the two groups included: a subjective evaluation through administration of questionnaires (BODY-Q^{TM}, a questionnaire assessing functional and aesthetic improvements after surgery, a questionnaire assessing the overall satisfaction), and an objective evaluation of pre- and post-operative pictures to estimate mons pubis suspension and result stability. Four minor complications were recorded: 1 wound dehiscence in A group, 3 seromas in AM group. All measured outcomes were higher in AM group, with statistically significant difference ($p < 0.05$) in almost all the questionnaire and BODY-Q^{TM} items, and the photographic assessment confirmed higher degree of mons pubis suspension and superior result stability in AM group. We presented a standardized approach to mons pubis reshaping during abdominoplasty, through a straightforward, safe and quick procedure. Our experience supports the significance of the concomitant correction of abdominal and mons pubis deformities, improving the results of the surgery from both a subjective and objective point of view.

ARTICLE HISTORY
Received 24 September 2021
Revised 9 February 2022
Accepted 29 March 2022

KEYWORDS
Abdominoplasty; monsplasty; pubic lift; postbariatric; massive weight loss; body contouring; BODY-Q

Introduction

Post-bariatric body contouring has gained popularity in the last decade as, even though the main purpose of weight loss is reduction in mortality and morbidity, the skin sequelae represent an enormous burden on post-bariatric patients [1]. Certainly, sagging of the abdominal skin is one of the main concerns patients seek advice for, given the skin rash in the abdominal folds, posture alteration and psycho-social implications [2].

Much attention is paid to the correction of the abdominal skin overhang following massive weight loss, often neglecting the pubis descent [3,4]. However, if pubic ptosis (with or without persistent fat deposits) is not adequately assessed and corrected, patients will become conscious of this condition following abdominoplasty and the overall improvement of the procedure may not be fully appreciated [5]. Matarasso and collegues identified the mons pubis as one of the abdominal related aesthetic units, advocating its reshaping during abdominoplasty [6]. Since then, puboplasty has evolved through different techniques, from the horizontal or vertical wedge excision in association or not with liposuction [3] to the use of liposuction only for pubis contouring, proposed by Hughes [7] and Pechevy [5]. Alter [8] advocated the undermining of the mons pubis up to the pubic symphysis and its suspension to the rectus fascia, associated with liposuction or open fat excision. Awadeen [9] described the use of exceeding deepithelialized pubic skin as a flap secured to the rectus fascia concomitant to the abdominoplasty. El Khatib [10] proposed different strategies depending on the severity of the ptosis, ranging from liposuction to deep lipectomy and subsequent pubic lift in a similar fashion as Bloom [11]. Finally, Marques [4] and Filho [12] suggested a resection-based monsplasty.

The aim of this study was to present our personal standardized approach to post-bariatric abdominal contouring with monsplasty as an integral part and to evaluate the outcomes, assessing result stability and patient satisfaction when compared to abdominoplasty only.

Materials and methods

The sample

Requirements of the Declaration of Helsinki as well as principles of GCP were taken into consideration. Patients gave full consent to use their personal data. Institutional review board approval was obtained before conducting the study.

We reviewed the clinical charts of massive weight loss (MWL) patients who underwent abdominal contouring surgery by the same surgeon between 2008 and 2018 at the Plastic and Reconstructive Surgery Unit of the 'Campus Bio-Medico University' in Rome, Italy. From 2014 on, the surgeon introduced monsplasty

CONTACT Paolo Marchica paolomarchica91@gmail.com Clinic of Plastic Surgery, University of Padua, Via Nicolò Giustiniani, 2, Padua, 35128, PD, Italy
†Current address: Paolo Marchica, MD, Piazzetta Giuseppe Bussolin 20, Padua, PD, 35137, Italy

as an integral part of every MWL abdominal contouring procedure.

A total of 69 patients received abdominoplasty only up to the end of 2013, while 94 patients received abdominoplasty and monsplasty between 2014 and 2018, for a total of 163 patients. All patients met specific inclusion and exclusion criteria prior to the surgery, as recommended by the latest massive weight loss patients' international guidelines [13,14]. Inclusion criteria in the study were represented by: BMI 30 Kg/m^2; minimum 6-month preoperative weight stability (at least 18 months after bariatric surgery); excess skin with persisting fat deposits and lipodystrophy at the abdomen and the mons (Grade 2 and 3 on Pittsburgh Rating Scale [15]; adequate nutritional status. Exclusion criteria were: severe comorbidities, precluding general anesthesia and major surgery, serum Hb level less than 11 g/dL, smoking habit (more than 5 cigarettes/day), uncontrolled psychological disorders or unrealistic expectations.

We selected 2 groups of 30 patients each: the first group underwent abdominoplasty only (A group), the second group underwent abdominoplasty and concomitant monsplasty (AM group). The selection process was conducted as follows: to be enrolled in the study, each patient must have had a complete clinical chart with all data to perform the study, at least 1 year follow-up with standardized photographs, and all the questionnaires filled with the answers. Among the 69 patients undergoing abdominoplasty without monsplasty, only 30 were suitable for the study. Hence, as regards AM group, we decided to take randomly six patients per year, for a total of 30 patients in five years in order to consider two samples of the same size. Demographics of the final sample are reported in detail in Table 1.

Operative technique

The abdominal midline was initially drawn with the patient in the standing position. Then, with the patient lying and the infraumbilical skin pulled upwards, the pubic component of the lower incision was marked 5–7 cm above the anterior vulvar commissure (or penopubic fold). The line was extended laterally and slightly upwards on each side, parallel to the groin fold. Utmost attention was paid to asymmetries. Fat deposits were marked in the standing position, if eligible to liposuction. Liposuction to the pubic area was planned in cases with persisting over-projecting mons despite its elevation.

Preoperatively, elastic stockings were applied to the legs and antibiotic prophylaxis was administered (cephazolin 2 g i.v.). The operation was performed under general anesthesia, and a urinary catheter was placed.

If pubic and/or abdominal liposuction was planned, this procedure was performed as first surgical step, preferring a wet (1:1 ratio) technique.

The skin was incised along the preoperative markings and a beveled dissection of the subcutaneous tissue was performed, reaching the rectus fascia roughly 5 cm above the skin incision. Cold blade undermining of the abdominal flap was carried out on a preaponeurotic plane as far as the xiphoid process and the costal margin, sparing the lateral musculocutaneous perforator vessels. The umbilicus was resected in a triangular shape, with the base placed superiorly, isolating, and preserving its stalk.

If necessary, midline plication of the anterior rectus sheath was then performed, using a nonabsorbable suture (0-0 polypropylene). When the midline plication alone did not allow proper tightening, an additional lateral 'L'-shaped plication of the muscular sheath was carried out on both sides.

Pubic elevation was then performed suspending the superficial fascia of the mons to the anterior sheet of the recti muscles fascia with nonabsorbable sutures (0-0 polypropylene): the first stitch was placed in the midline, setting the desired level of suspension and being cautious to avoid external genitalia distortion. The upper-lateral ends of the mons were then lifted following a superolateral vector: two stitches were placed 6–7 cm apart from the midline on both sides of the pubis anchoring the pubic superficial fascia more laterally on the rectus aponeurosis. This maneuver redistributed the horizontal pubic skin excess. Additional sutures were placed laterally to the mons on both sides, in order to uplift the superficial fascia of the anterior thigh. Finally, further intermediate stitches were placed along the pubis to consolidate its suspension. No undermining of the mons was performed.

Excess skin and subcutaneous tissue were assessed and resected. Superficial fascia continuity between the upper abdominal flap and the pubic/lower abdominal flap was restored using 2–0 polyglactin 910 sutures. This further consolidated the pubic fascial suspension.

Table 1. Patients' demographics. No statistically significant differences were found between groups as regards distribution of demographics data ($p > 0.05$), as gender, age, BMI, weight reduction, weight loss modality, and comorbidities (diabetes mellitus and smoking habit).

Demographics	A group (abdominoplasty)	AM Group (abdominoplasty + monsplasty)
N° of patients	30	30
Males	5	8
Females	25	22
Age (years)	45.21 ± 4.56	42.34 ± 5.43
Prior weight loss BMI (kg/m^2)	42.81 ± 3.98	40.73 ± 3.45
Prior plastic surgery BMI (kg/m^2)	24.7 ± 3.34	24.44 ± 3.67
ΔBMI (kg/m^2)	18.11 ± 3.18	16.29 ± 3.27
Weight reduction (kg)	51.88 ± 5.16	48.84 ± 5.64
Weight loss (WL) modality	2 non surgical 28 surgical	4 non surgical 26 surgical
Non-surgical WL	2	4
Surgical wl	28	26
Sleeve gastrectomy (SG)	21	15
Laparoscopica adjustable gastric banding (LAGB)	5	5
Gastric bypass (GBP)	2	5
Biliopancreatic diversion (BPD)	0	1
Diabetes mellitus	13 yes, 17 no	9 yes, 21 no
Smoking habit	14 yes, 16 no	9 yes, 21 no

The skin edges were approximated through subcutaneous and intradermal sutures with 3-0 polyglactin 910. A 'Y' shaped incision was performed on the midline so as to create a recipient site for the umbilicus in its anatomical position. Suction drains were placed, and a compressive dressing was applied.

Postoperative care

Antibiotics were administered until two days after the drains' removal, and painkillers were routinely prescribed. Low-molecular-weight heparin was administered within 12 h after the surgery and for the following 5 days, as MWL patients present higher risk for thromboembolic events [16].

On the second postoperative day, the urinary catheter was removed, and wounds were checked and dressed. A compressive garment, covering the abdomen and suspending the pubis and the thighs, was applied before the discharge and worn day and night for at least two months after the operation. Drains were normally removed in 4–6 days, and wounds were checked at 1 and 2 weeks postoperatively. Patients were instructed to use scar tape over the scars for three months following the surgery and, after that period, silicone gel was applied till full scar maturation. All patients were reviewed at 1, 3, 6, 12 months postoperatively and, at each visit, standardized pictures were taken (Figures 1 and 2).

Patients' assessment

Patients' assessment was conducted through review of clinical charts, administration of questionnaires and comparison of pre-operative, 1-month and 12-months postoperative frontal view photographs.

Clinical charts provided demographics such as sex, age, weight history (prior weight loss and prior plastic surgery weight and BMI), BMI variation before weight loss and before plastic surgery (or ΔBMI), weight loss modality (surgical or non-surgical, and the type of bariatric procedure), smoking habit (including patients with 5 or less cigarette/day) and diabetes mellitus.

At the time the study was conceived (2020), all patients recruited were asked to fill out 3 anonymous questionnaires sent by e-mail, which were recorded and analysed:

- BODY-Q^{TM} [17,18], a patient-reported outcome instrument composed of scales measuring the appearance, the health-related quality of life and the process of care; more specifically, 4 BODY-Q^{TM} appearance scales measuring satisfaction (satisfaction with abdomen, body, excess skin, scars) and 7 BODY-Q^{TM} quality of life scales measuring expectation on how appearance and quality of life might change after treatment and appearance-related distress (appearance-related psychosocial distress, body image, physical functions, obesity symptoms, psychological function, sexual function, social function) were administered; raw summed scale scores were converted in equivalent transformed Rasch scores.
- A survey entailing 11 items, to assess functional and aesthetic improvement related to the pubis, following the abdominoplasty surgery (skin discomfort e.g. rash, local infections; ease in maintaining proper hygiene; aesthetics of the mons pubis in frontal view and in side view; ease in finding suitable clothes and how the clothes fit on one's pubis; embarrassment in showing one's body dressed, in swimwear and naked; social relationship; sexual activity; overall quality of life). For each question, patients could choose one out of four answers, each associated with a numeric score: 1 = no improvement, 2 = slight improvement, 3 = good improvement, or 4 = excellent improvement.
- A single question concerning the overall degree of satisfaction after the abdominal contouring surgery, with a score ranging from 1 (poor) to 10 (excellent).

Finally, we compared the preoperative, 1-month and 12-months postoperative frontal view photographs, to demonstrate the suspension of the mons pubis and its stability over time. In order to obtain reasonable standardization, all the pictures were taken in a photography studio set up in our department, using a tripod-mounted camera pointed at the level of the umbilicus. Patients were photographed in a standing position with hands behind their back and legs slightly abducted (feet about 25 cm apart). A specific software was used to superimpose and compare the pictures (Pixelmator PRO, Pixelmator Team Ltd, London, UK). Two reference horizontal lines were drawn on the pictures using anatomical landmarks. The anatomical landmarks to identify the upper line (A line) were represented by the superficial fascia adherences to the underlying musculoskeletal system in proximity to the iliac crest, described by Lockwood [19]. This tethering produces visible indentations on the lateral trunk contour, which remain stable in the same patient despite weight fluctuations. More specifically, in males, this area of adherence corresponds to the iliac crest, while in females it lies few centimeters lower, at the level of the gluteal depression. The anatomical landmarks to identify the lower line (B line) was the anterior vulvar commissure (or penopubic junction) or, when these were not visible in the preoperative frontal view, the lowermost point of the pubis. The upper line was constant due to its nature related to zones of

Figure 1. preoperative and 12-months postoperative frontal view photographs after abdominoplasty and monsplasty in male patient.

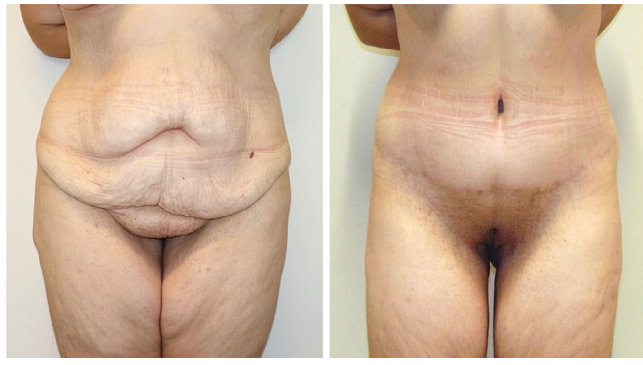

Figure 2. preoperative and 12-months postoperative frontal view photographs after abdominoplasty and monsplasty in female patient.

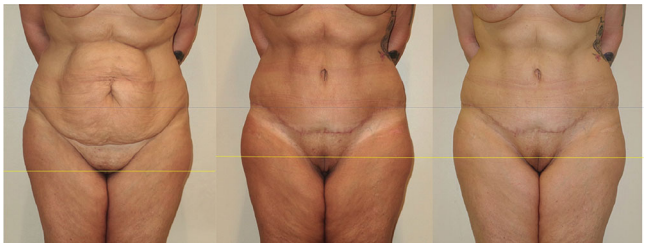

Figure 3. From left to right, comparison of the preoperative, 1-month and 12-months postoperative frontal view photographs after abdominoplasty and monsplasty, to demonstrate the suspension of the mons and its stability over time. The yellow line represents the A line passing by the superficial fascia adherences to the underlying musculoskeletal system in proximity to the iliac crest. This landmark remains stable in the same patient despite weight fluctuations. More specifically, in males, this area of adherence corresponds to the iliac crest, while in females it lies few centimeters lower, at the level of the gluteal depression. The blue line represents the B line corresponding to a horizontal line passing by the anterior vulvar commissure in females (or penopubic junction in males) or, if these landmarks are not visible in the preoperative frontal view, the B line passes by the lowermost point of the pubis. The B line varies according to the mons position. Mons suspension and stability are demonstrated by maintenance of the same height of the B line at 1-month and 12-months postoperative.

adherence, while the lower line varied according to the mons position. So, the higher the pubis, the closer the lines.

The distance between these two lines (AB) was calculated in the preoperative (AB preop), 1-month (AB 1 m) and 12-months (AB 12 ms) postoperative pictures and the percentage variation of distance between the lines was assessed, describing the mons suspension at 1 month [(ABpreop – AB 1 m)/ABpreop], or AB', and at 12 months [(ABpreop – AB 12 ms)/ABpreop], or AB'' postoperative. Furthermore, loss of mons suspension at 12 months postoperative was calculated to demonstrate stability over time, as [(AB'-AB'')/AB''] and described as loss of mons suspension at 12 months postoperative percentage (Figure 3).

Data record was performed using Microsoft Excel for Mac OS, Ver. 16.45 (© 2021 Microsoft), while statistical analysis was performed using IBM® SPSS® Statistics per Mac OS, Ver. 25 (© IBM Corporation) featuring Shapiro-Wilk test to assess the non-normality of distribution, 2-tailed Fisher exact test for binary categorical data and 2-tailed Mann-Whitney U test for continuous variables. *P*-values <0.05 were considered statistically significant.

Results

We reported a total of 4 patients presenting postoperative complications among the groups (Table 2A). The A group had 1 complication only (wound dehiscence), the AM group had 3 complications (seromas), but all of them were considered minor as treated on an out-patient basis. No major complications were reported and no scars displacement or asymmetry, genitalia distortion or recurrent ptosis of the mons were registered.

The BODY-Q^{TM} (Table 2B) questionnaire showed significantly higher scores in the AM group in 6 out of 11 scales: appearance-related psychosocial distress, body image, physical function, obesity symptoms, satisfaction with body, appraisal of scars ($p < 0.05$). The remnant 5 scales (psychological function, sexual function, social function, satisfaction with abdomen, appraisal of excess skin) showed no statistically significant difference ($p > 0.05$), as the mean final scores appeared similar in the two groups.

The authors' 11-items survey assessing the functional and aesthetic pubic outcomes (Table 2C) showed significant differences between cohorts in 8 out of 11 items: aesthetics of the mons pubis in frontal and side-view, ease in finding suitable clothes and how the clothes fit on one's pubis, embarrassment in showing one's body in swimwear and naked, social relationship, sexual activity, and overall quality of life ($p < 0.05$). However, mean final scores in 3 out of 11 items showed no statistically significant difference (skin discomfort, ease in maintaining proper hygiene, embarrassment in showing one's body dressed), with $p > 0.05$. The mean scores of the 11 items were 2.87 ± 0.80 out of 4 for the A group and 3.45 ± 0.42 out of 4 for the AM group, with a statistically significant difference ($p < 0.05$) observed between the groups. The overall satisfaction with the abdominal contouring surgery was rated 9.47 ± 0.73 out of 10 in the AM group, and 9.07 ± 1.20 out of 10 in the A group, with no statistically significant difference ($p > 0.05$).

Photographic assessment (Table 2D) showed a mean 1-month mons elevation of $40.74 \pm 13.16\%$ in the AM group and a $16.00 \pm 6.94\%$ in the A group ($p < 0.05$). The 12-months evaluation revealed a mons elevation of $32.89 \pm 15.46\%$in the AM group and a $10.35 \pm 5.07\%$ in the A group ($p < 0.05$). Mean loss of mons suspension ratio was $21.31 \pm 17.83\%$ in the AM group and $33.04 \pm 20.19\%$ in the A group ($p < 0.05$).

Sex stratification investigation showed no statistically significant difference ($p > 0.05$) between females and males as regards the questionnaires BODY-Q^{TM} (Table 2B) and the authors' 11-items survey (Table 2C), except for a borderline *p*-value ($p > 0.05$, but $p < 0.1$) in the AM group concerning physical function in BODY-Q^{TM} questionnaire and sexual activity in the 11-items survey, both perceived better in males.

Finally, sex stratification applied to photographic assessment (Table 2D) showed a statistically significant difference ($p < 0.05$) between female and male patients, as regards the 1-month and 12-month mons suspension (%) in patients performing abdominoplasty and monsplasty (AM group). No statistically significant differences ($p > 0.05$) were observed between females and males receiving abdominoplasty only (A group), related to the 1-month and 12-months mons suspension (%). Lastly, no statistically significant differences ($p > 0.05$) were reported between females and males in both groups (A group and AM group) in terms of loss of mons suspension at 12 months postoperatively (%).

Discussion

MWL patients complain about trunk deformities involving both the abdomen and the mons pubis, due to skin and soft tissue redundancy. Even though abdominoplasty improves the aesthetic contour of the lower trunk, dissatisfaction may still occur as regards the deformity of the pubic region, which appears more noticeable due to the 'uncovering' of the mons pubis from the abdominal apron. Therefore, monsplasty represents a complementary surgery to abdominoplasty and bodylift procedures [3]. The aim of this research was to demonstrate and assess the subjective and objective improvement obtained by combining abdominoplasty and monsplasty.

The assessment of the questionnaires in the two cohorts, A group and AM group, showed statistically significant higher scores in the concurrent procedure group.

Due to the retrospective nature of the study, the BODY-Q^{TM} was not administered preoperatively, nevertheless the BODY-Q^{TM} was a validated and reliable tool to assess satisfaction with body appearance and quality of life following body-contouring [17,18]. In fact, we compared the postoperative scores in the two cohorts of patients. The BODY-Q^{TM} questionnaire showed remarkably higher scores as regards satisfaction with body appearance and scars after body contouring surgery and quality of life (appearance-related psychosocial distress, body image, physical function,

Table 2A. Outcomes (Postoperative complications). Statistically significant *p*-values are marked in bold fonts.

Outcomes	A group (abdominoplasty)	AM Group (abdominoplasty + monsplasty)	p-value
Postoperative complications			
Overall postoperative complications	1 yes, 29 no	3 yes, 27 no	$p > 0.05$ (0.612)
Wound dehiscence	1 yes, 29 no	0 yes, 30 no	$p > 0.05$ (1.000)
Seroma	0 yes, 30 no	3 yes, 27 no	$p > 0.05$ (0.237)

Table 2B. Outcomes (BODY-Q™, BODY-Q© 2016 Memorial Sloan-Kettering Cancer Center, all rights reserved[17, 18], all patients considered globally, evaluating differences between abdominoplasty and abdominoplasty + monsplasty groups (last column), and stratified by gender, evaluating differences between males and females in the same group (3rd column of each group).

Outcomes	A group (abdominoplasty)			AM Group (abdominoplasty + monsplasty)			*p* value (A group vs. AM group)
BODY-Q™ [17,18]	Average equivalent transformed Rasch scores (0 to 100)			Average equivalent transformed Rasch scores (0 to 100)			
Appearance-related psychosocial distress (0 as best, 100 as worse)	41.47 ± 22.28			17.90 ± 20.82			**$p < 0.05$ (0.000083)**
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	42.23 ± 22.52	37.60 ± 23.14	(0.787)	18.59 ± 21.87	16.00 ± 18.82	(0.982)	
Body image (0 as worse, 100 as best)	46.40 ± 18.47			67.67 ± 31.81			**$p < 0.05$ (0.019)**
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	46.23 ± 18.57	46.80 ± 20.10	(0.787)	68.50 ± 32.69	65.38 ± 31.28	(0.597)	
Physical function (0 as worse, 100 as best)	40.63 ± 20.80			88.83 ± 14.28			**$p < 0.05$ (0.000001)**
	F	M	$p > 0.05$	M	F	$p > 0.05$ (0.087)	
	41.80 ± 20.91	34.80 ± 21.46	(0.627)	86.09 ± 14.73	96.37 ± 10.25		
Obesity symptoms (RAW summed scores, 0 TO 40, 0 as worse, 40 as best)	29.90 ± 3.06			35.53 ± 3.68			**$p < 0.05$ (0.000001)**
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	29.76 ± 3.32	30.60 ± 0.89	(0.552)	35.36 ± 4.11	36.00 ± 2.27	(0.801)	
Psychological function (0 as worse, 100 as best)	72.07 ± 13.81			75.50 ± 25.21			$p > 0.05$ (0.366)
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	72.00 ± 13.55	72.40 ± 16.76	(1.000)	75.36 ± 24.80	75.87 ± 28.07	(0.662)	
Sexual function (0 as worse, 100 as best)	64.17 ± 17.40			65.93 ± 22.37			$p > 0.05$ (0.259)
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	64.16 ± 17.19	64.20 ± 20.57	(1.000)	64.72 ± 20.65	69.25 ± 27.87	(0.872)	
Social function (0 as worse, 100 as best)	75.07 ± 13.56			76.53 ± 18.17			$p > 0.05$ (0.692)
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	75.32 ± 13.14	73.80 ± 17.15	(0.706)	77.32 ± 18.95	74.38 ± 16.84	(0.765)	
Satisfaction with abdomen (0 as worse, 100 as best)	84.43 ± 16.48			83.30 ± 17.53			$p > 0.05$ (0.976)
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	85.16 ± 16.13	80.80 ± 19.69	(0.666)	83.00 ± 17.37	84.13 ± 19.16	(0.909)	
Satisfaction with body (0 as worse, 100 as best)	58.60 ± 20.02			63.57 ± 15.28			**$p < 0.05$ (0.024)**
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	58.36 ± 19.94	59.80 ± 22.73	(1.000)	65.41 ± 17.22	58.50 ± 6.02	(0.344)	
Appraisal of excess skin (0 as worse, 100 as best)	65.23 ± 21.50			69.67 ± 33.58			$p > 0.05$ (0.190)
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	66.24 ± 21.97	60.20 ± 20.39	(0.448)	67.68 ± 38.07	75.13 ± 16.56	(0.692)	
Appraisal of scars (0 as worse, 100 as best)	61.10 ± 11.48			86.47 ± 14.20			**$p < 0.05$ (0.000001)**
	F	M	$p > 0.05$	M	F	$p > 0.05$	
	61.92 ± 12.37	57.00 ± 3.46	(0.552)	84.82 ± 12.51	91.00 ± 18.27	(0.202)	

Statistically significant *p*-values are marked in bold fonts. Borderline statistically significant *p*-values are marked in underlined fonts.

and obesity symptoms), after a combined procedure, suggesting that mons pubis reshaping yielded a more satisfying perception of the whole body, as well as a functional improvement.

The specific 11-items' questionnaire which focused on the functional and aesthetic improvement in the pubis showed outstanding scores in patients with monsplasty, with a subjective improvement rated between 'good improvement' and 'excellent improvement' for all the items (average of the mean scores of the 11 items: 3.45 ± 0.42 out of 4). On the other hand, the patients who underwent abdominoplasty only (rated pubic improvement between 'slight improvement' and 'good improvement' for all the items (average of the mean scores of the 11 items: 2.87 ± 0.80 out of 4). A statistically significant difference was found among the group ($p < 0.05$). This finding suggested that abdominoplasty itself made some minor improvements to the pubic area.

Finally, both groups showed a very high degree of overall satisfaction with their abdominal contouring surgery and, even though the difference was not statistically significant between the two, the patients who received concomitant monsplasty reported higher scores.

We carried out an objective evaluation of the pubic uplift by comparing preoperative and postoperative pictures. The analysis of the percentage elevation of the pubis in the two groups showed a considerable suspension of the pubis when monsplasty was performed, in conversely to the patients who received abdominoplasty only. Furthermore, in the group with combined procedures, the comparison of the pictures at 1 and 12 months postoperatively showed consistently stable results, with minimum ptosis recurrence at 12 months. This finding accounted for some minor overcorrection of the ptosis.

Despite both male and female patients presented comparable percentage mons suspension at 1 and 12 months postoperatively in the A group, the percentage pubic uplift appeared different in the 2 genders in the AM group. Indeed, males presented reduced

Table 2C. Outcomes (Authors' 11 items survey: 'Following abdominoplasty, in addition to the improvement achieved in the abdominal region, what kind of improvement do you think you have obtained in the pubis regarding the following aspects?' 1 = no improvement, 2 = slight improvement, 3 = good improvement, or 4 = excellent improvement; overall satisfaction; overall satisfaction), all patients considered globally, evaluating differences between abdominoplasty and abdominoplasty + monsplasty groups (last column), and stratified by gender, evaluating differences between males and females in the same group (3rd column of each group).

Outcomes	A group (abdominoplasty)			AM Group (abdominoplasty + monsplasty)			*p* value (A group vs. AM group)
Authors' 11-items survey		Average score (1 to 4)			Average score (1 to 4)		
Skin discomfort (e.g. rash, local infections)		2.77 ± 0.97			3.17 ± 1.18		$p > 0.05$ (0.113)
	F	M	$p > 0.05$	F	M	$p > 0.05$ (0.393)	
	2.76 ± 0.97	2.80 ± 1.10	(1.000)	3.32 ± 1.04	2.75 ± 1.49		
Ease in maintaining proper hygiene		3.00 ± 0.83			3.20 ± 1.03		$p > 0.05$ (0.209)
	F	M	$p > 0.05$	F	M	$p > 0.05$	
	3.00 ± 0.82	3.00 ± 1.00	(1.000)	3.32 ± 0.89	2.88 ± 1.36	(0.597)	
Aesthetics of the mons pubis in frontal view		2.83 ± 1.02			3.67 ± 0.48		**$p < 0.05$ (0.001)**
	F	M	$p > 0.05$	F	M	$p > 0.05$	
	2.84 ± 1.03	2.80 ± 1.10	(0.957)	3.63 ± 0.49	3.75 ± 0.46	(0.662)	
Aesthetics of the mons pubis in side-view		2.97 ± 0.85			3.77 ± 0.43		**$p < 0.05$ (0.000024)**
	F	M	$p > 0.05$	F	M	$p > 0.05$	
	2.96 ± 0.84	3.00 ± 1.00	(0.957)	3.73 ± 0.46	3.87 ± 0.35	(0.565)	
Ease in finding suitable clothes and how the clothes fit on one's pubis		2.50 ± 0.90			3.30 ± 1.02		**$p < 0.05$ (0.001)**
	F	M	$p > 0.05$	F	M	$p > 0.05$	
	2.48 ± 0.92	2.60 ± 0.89	(0.787)	3.36 ± 0.90	3.12 ± 1.36	(1.000)	
Embarrassment in showing one's body dressed		3.13 ± 0.82			3.10 ± 1.19		$p > 0.05$ (0.646)
	F	M	$p > 0.05$	F	M	$p > 0.05$	
	3.12 ± 0.83	3.20 ± 0.84	(0.872)	3.27 ± 1.03	2.62 ± 1.50	(0.447)	
Embarrassment in showing one's body in swimwear		2.97 ± 0.77			3.57 ± 0.82		**$p < 0.05$ (0.001)**
	F	M	$p > 0.05$	F	M	$p > 0.05$	
	2.96 ± 0.79	3.00 ± 0.71	(0.914)	3.59 ± 0.73	3.50 ± 1.07	(0.872)	
Embarrassment in showing one's body naked		2.87 ± 0.86			3.60 ± 0.81		**$p < 0.05$ (0.001)**
	F	M	$p > 0.05$ (0.829)	F	M	$p > 0.05$	
	2.88 ± 0.88	2.80 ± 0.84		3.59 ± 0.73	3.62 ± 1.06	(0.534)	
Social relationship		2.77 ± 1.01			3.73 ± 0.69		**$p < 0.05$ (0.000058)**
	F	M	$p > 0.05$ (0.914)	F	M	$p > 0.05$	
	2.76 ± 0.97	2.80 ± 1.30		3.73 ± 0.70	3.75 ± 0.71	(0.872)	
Sexual activity		2.90 ± 0.89			3.33 ± 0.84		**$p < 0.05$ (0.049)**
	F	M	$p > 0.05$ (0.829)	F	M	$\underline{p < 0.05}$	
	2.88 ± 0.88	3.00 ± 1.00		3.18 ± 0.85	3.75 ± 0.71	$\underline{(0.087)}$	
Overall quality of life		2.83 ± 0.99			3.57 ± 0.68		**$p < 0.05$ (0.003)**
	F	M	$p > 0.05$ (0.957)	F	M	$p > 0.05$	
	2.84 ± 0.99	2.80 ± 1.10		3.50 ± 0.74	3.75 ± 0.46	(0.565)	
Average of the mean scores of the 11 items		2.87 ± 0.80			3.45 ± 0.42		**$p < 0.05$ (0.010)**
	F	M	$p > 0.05$	F	M	$p > 0.05$	
	2.86 ± 0.81	2.89 ± 0.90	(1.000)	3.48 ± 0.37	3.40 ± 0.56	(0.872)	
Satisfaction							
Overall satisfaction (1 to 10)		9.07 ± 1.20			9.47 ± 0.73		$p > 0.05$ (0.137)
	F	M	$p > 0.05$	F	M	$p > 0.05$	
	9.08 ± 1.29	9.00 ± 7.07	(0.552)	9.45 ± 0.80	9.50 ± 0.53	(0.872)	

Statistically significant *p*-values are marked in bold fonts. Borderline statistically significant *p*-values are marked in underlined fonts.

percentage of mons suspension compared with females. However, result stability appeared comparable between males and females both in the A and AM cohorts, suggesting that both procedures presented similar time lasting outcomes between genders, despite a superior result with the combined procedure. Sex stratification did not show any difference in ptosis recurrence over time both in photographic assessment and questionnaires' items.

Similar functional and aesthetic improvements of the mons region were reported by Bloom [11] when combining abdomen and pubic contouring, as patients experienced improvement in sexual function, ease in maintaining hygiene and visualization of their genitalia, solving the hooding issue and restoring a youthful contour. Pechevy [5] reported self-esteem and aesthetic improvement and functional benefits after monsplasty in combination with abdominoplasty as well.

No additional complications were observed in our sample in relation to concomitant abdominoplasty and puboplasty which could be directly attributed to pubic contouring, suggesting the safety of concurrent monsplasty.

Puboplasty technique developed over the years since the contribution of wedge resection technique described by Matarasso[3] . Progressive introduction of liposuction of the pubis [5,7,10,11], recti muscle fascia suspension and mons pubis undermining [8], recycling of deepithelialized pubic skin as pubic brace to the recti muscles fascia [9] and resection-based monsplasty [4,12], represent different solutions identified by the various authors to address such a complex area as the mons pubis. In fact, a standard technique capable of providing a solution to all the deformities of the pubis cannot be identified. It is indisputable that, since its development, puboplasty plays a major role in post-bariatric lower abdomen contouring, as it addresses the morpho-functional limitations related to pubic ptosis, which are not corrected through a conventional abdominoplasty. However, our personal technique should not be considered a mere uplift or pubopexy,

Table 2D. Outcomes (Photographic assessment), all patients considered globally, evaluating differences between abdominoplasty and abdominoplasty + monsplasty groups (last column), and stratified by gender, evaluating differences between males and females in the same group (3rd column of each group).

Outcomes	A group (abdominoplasty)			AM Group (abdominoplasty + monsplasty)			*p* VALUE (A group vs. AM group)
Photographic assessment							
AB′ (mons suspension at 1 month postoperative) (%)		16.00 ± 6.94%			40.74 ± 13.16%		**$p < 0.05$ (0.000001)**
	F	M	$p > 0.05$	F	M	**$p < 0.05$**	
OR [(ABPREOP – AB 1M)/ ABPREOP] (%)	31.44 ± 18.12%	36.77 ± 25.20%	(0.229)	44.48 ± 12.96%	30.45 ± 6.95%	**(0.006)**	
AB′′ (mons suspension at 12 months postoperative) (%)		10.35 ± 5.07%			32.89 ± 15.46%		**$p < 0.005$ (0.000001)**
	F	M	$p > 0.05$	F	M	**$p < 0.05$**	
OR [ABPREOP – AB 12MS)/ ABPREOP] (%)	14.68 ± 5.66%	19.09 ± 8.90%	(0.251)	35.91 ± 15.82%	24.60 ± 11.53%	**(0.040)**	
Loss of mons suspension at 12 months postoperative (%)		33.04 ± 20.19%			21.31 ± 17.83%		**$p < 0.05$ (0.036)**
	F	M	$p > 0.05$	F	M	$p > 0.05$	
	9.91 ± 3.97%	11.36 ± 7.22%	(0.275)	21.20 ± 18.05%	21.62 ± 18.42%	(0.475)	

Statistically significant *p*-values are marked in bold fonts. Borderline statistically significant p-values are marked in underlined fonts.

as it aims at reshaping the pubis through various phases, which can be integrated into an abdominoplasty:

1. **Liposuction**: it is indicated in patients with ptosis and persisting fat deposits in the pubic area, in which a mere uplift would solely allow to achieve a bulging pubis in a higher position. When performing liposuction to the pubis we must bear in mind the anatomical differences between females and males, preserving the physiological mound in the female pubis, the so called 'mons Veneris'. Conversely, in male patients, a more aggressive liposuction may be indicated, especially in case of buried penis. The subcutaneous tissue in the pubis is lightened, reducing the risk of ptosis recurrence. The blunt dissection performed with the cannula facilitates the pubic tissues mobility and elevation. Moreover, we avoid aggressive undermining and detaching the subcutaneous tissue from the deep fascia, with no resulting dead space and reduced risk of seroma. Liposuction spares the fascial septa and lymphatics, as opposed to direct lipectomy, so the risk of lymphatic drainage impairment and subsequent lymphoedema is reduced [20]. No persisting oedema of the pubic area was observed following liposuction. We believe that a proper compression garment worn for at least two months significantly contributed to this.
2. **Skin excess removal through a very low incision in the pubis**: sagging skin with extreme laxity, inelasticity, and scattered stretch marks, partially or fully covering the external genitalia, may be observed in the pubic area following MWL. This skin may significantly be stretched and lifted, so its excess may be underestimated. Thus, it's mandatory to stretch the skin upwards forcefully to exactly locate the site of the horizontal incision, which in some cases may be 5 cm or less off the vulvar commissure (or peno-pubic fold). This way, a considerable amount of pubic skin is often excised and, at the same time, the incision is kept low.
3. **Pubic suspension and skin redistribution following superolateral vectors**: in severe cases, a horizontal skin excess may also be observed, which is not corrected through a mere uplift. This abundant horizontal skin can be redistributed by pulling it upwards and laterally. Some authors advocate a vertical wedge excision [3,12], but in our experience this additional excision is not necessary. It is noteworthy that we always perform a superficial fascial suspension laterally to the pubis, to further redistribute the skin properly. This lateral suspension also allows to achieve an anterior and medial thigh uplift. In extreme cases, this superolateral redistribution may result in evident lateral skin puckering. In these cases, a flankplasty is normally indicated.
4. **Re-establishment of superficial fascia continuity, with suspension of the superficial fascia in the lower flap**: we firmly believe that superficial fascial continuity between the upper abdominal and lower abdominal flaps plays a major role in stabilizing the pubic and anterior and medial thigh elevation. The compression garment has a suspension function of the thighs and pubis and contributes to the stabilization.

The abovementioned puboplasty technique is easily integrated into an abdominoplasty, as the suspension is performed at the end of the recti muscles' aponeurosis plication, using the same sutures, and it may be considered an additional step to the rectus fascia plication [21].

Hence, puboplasty is a straightforward procedure that, timewise, is quick, taking less than 10 min to be completed. The different phases can be adjusted according to the case, so the correction is very flexible.

It is noteworthy that puboplasty allows to correct the hooding of both female and male external genitalia. In selected cases, further procedures are required to correct hidden penis and labia majora enlargement [8,22,23]. Finally, puboplasty should be performed before a thigh lift, as the correction of the skin overhang in the groin area eliminates the skin fold at the site of the thigh lift incisions. In fact, exposed wounds are less prone to infection and maceration.

The retrospective nature of the study may be considered the main limitation of our research. Furthermore, the sample is relatively small since an important number of patients didn't answer the questionnaire or complete the follow up, or had their data lost. This lack of data, mostly affecting the patients undergoing abdominoplasty only, led us to randomly select a part of the patients undergoing abdominoplasty and monsplasy, in order to create two groups of equal size, even if smaller.

Even if the senior author has maintained the same abdominoplasty surgical technique, his expertise has grown up over the years, and the residents assisting him have been several and

changed over the years. These may be considered as confounding factors.

The fact that a single surgeon experience is reported may be a drawback, as it implies to generalize the results and does not allow to analyze the outcomes of this technique in the hands of other surgeons. Nevertheless, our technique consists in a simple and standardized approach that, in our opinion, may be easily reproducible with a fast learning curve.

All the questionnaires were administered at the time the study was conceived, thus in 2020: this is certainly a limitation because the patients of the two groups underwent surgery at different times, with several variables and factors occurring and impacting in the filling of questionnaires, such as aging, recurrence, degree of scars maturation, swelling, etc. For this reason, we didn't employ further specific assessments of scarring, as scar scales evaluation system, apart for the one included in the BODY-Q^{TM}. On the contrary, the photographic evaluation was performed on pictures taken at the same postoperative time for all the patients.

As far as the photographic evaluation is concerned, we tried to achieve the highest standardization, by taking all the pictures in the same environmental condition of light and distance from the camera. However, some degree of inaccuracy was obviously present.

Since patients requesting this kind of surgery are mostly females, the number of males in our sample was limited. Hence, sex stratification analysis can only be taken into consideration, aware of this limitation.

Despite these issues were encountered in the drafting of the article, to the best of our knowledge this is the only study assessing the effectiveness of the monsplasty as an integral part of the abdominal contouring in MWL patients from both a subjective and an objective perspective. Indeed, we investigated both the surgeon and the patient's point of view. In our opinion, this modality of photographic comparison may be useful for surgeons to assess the results of the abdominal contouring surgery and their stability, achieving a reasonable degree of accuracy. Furthermore, we proposed a comprehensive surgical approach to the mons pubis, which is standardized and easily reproducible by any plastic surgeon who wants to approach body remodeling, considering together the need of correcting both the abdomen and the pubis.

Conclusion

The first corrective procedure performed on patients following MWL is usually an abdominoplasty. In most cases, pubic ptosis is associated. This condition can be rectified secondarily, but it is undeniable that concomitant correction (abdominoplasty and monsplasty) implies multiple advantages for the patients if performed at the same time. Our experience suggests that combining abdominoplasty and puboplasty may be considered a consistent safe and effective procedure to obtain satisfactory overall abdominal contouring.

Ethical approval

Requirements of the Declaration of Helsinki as well as principles of GCP were taken into consideration. Patients gave full consent to use their personal data. Institutional review board approval was obtained before conducting the study.

Disclosure statement

No potential competing interest was reported by the authors. Authors have nothing to disclose. No funding was received for this article.

ORCID

Paolo Marchica http://orcid.org/0000-0002-2108-2979

References

[1] Orpheu SC, Coltro PS, Scopel GP, et al. Collagen and elastic content of abdominal skin after surgical weight loss. Obes Surg. 2010;20(4):480–486.

[2] Giordano S, Victorzon M, Koskivuo I, et al. Physical discomfort due to redundant skin in post-bariatric surgery patients. J Plast Reconstr Aesthet Surg. 2013;66(7):950–955.

[3] Matarasso A, Wallach SG. Abdominal contour surgery: treating all aesthetic units, including the mons pubis. Aesthet Surg J. 2001;21(2):111–119.

[4] Marques M, Modolin M, Cintra W, Gemperli R, et al. Monsplasty for women after massive weight loss. Aesthetic Plast Surg. 2012;36(3):511–516.

[5] Pechevy L, Gourari A, Carloni R, et al. Monsplasty after massive weight loss: assessment of its aesthetic and functional impact. Ann Chir Plast Esthet. 2016;61(1):e21–e35.

[6] Matarasso A. Liposuction as an adjunct to a full abdominoplasty revisited. Plast Reconstr Surg. 2000;106(5):1197–1202. discussion 1203–5.

[7] Hughes C. Body contouring of the suprapubic region. Aesthet Surg J. 2000;20(5):411–412.

[8] Alter GJ. Management of the mons pubis and labia majora in the massive weight loss patient. Aesthet Surg J. 2009;29(5):432–442.

[9] Awadeen AR. Monsplasty: new technique. J Plast Reconstr Surg. 2013;37:107–109.

[10] El-Khatib HA. Mons pubis ptosis: classification and strategy for treatment. Aesthetic Plast Surg. 2011;35(1):24–30.

[11] Bloom JM, Van Kouwenberg E, Davenport M, et al. Aesthetic and functional satisfaction after monsplasty in the massive weight loss population. Aesthet Surg J. 2012;32(7):877–885.

[12] Filho JM, Belerique M, Franco D, et al. Dermolipectomy of the pubic area associated with abdominoplasty. Aesthetic Plast Surg. 2007;31(1):12–15.

[13] BAPRAS. UK Commissioning guide: Massive Weight Loss Body Contouring. London: British Association of Plastic, Reconstructive and Aesthetic Surgeons, The Royal College of Surgeons of England; 2017. [accessed 2021 Jul 8]. https://www.bapras.org.uk/docs/default-source/commissioning-and-policy/2017–draft-for-consultation–body-contouring-surgery-commissioning.pdf?sfvrsn=0

[14] ASPS. Patients, Practice Parameter for Surgical Treatment of Skin Redundancy for Obese and Massive Weight Loss. Arlington Heights, Illinois: American Society of Plastic Surgeons; 2017. [accessed 2021 Jul 8]. Available from: https://www.plasticsurgery.org/documents/Health-Policy/Guidelines/guideline-2017-skin-redundancy.pdf

[15] Song AY, Jean RD, Hurwitz DJ, et al. A classification of contour deformities after bariatric weight loss: the pittsburgh rating scale. Plast Reconstr Surg. 2005;116(5):1535–1544. Octdiscussion 1545–6.

[16] Pai M, Douketis JD. Prevention of venous thromboembolic disease in adult nonorthopedic surgical patients. In: UpToDate, Post, TW (Ed), UpToDate, Waltham, MA. 2021. [accessed 2021 Jul 8]. https://www.uptodate.com/contents/prevention-of-venous-thromboembolic-disease-in-adult-nonorthopedic-surgical-patients

[17] Klassen AF, Cano SJ, Scott A, et al. Assessing outcomes in body contouring. Clin Plast Surg. 2014;41(4):645–654.

[18] Klassen AF, Cano SJ, Alderman A, et al. The BODY-Q: a Patient-Reported outcome instrument for weight loss and body contouring Treatments. Plast Reconstr Surg Glob Open. 2016;4(4):e679.

[19] Lockwood TE. Superficial fascial system (SFS) of the trunk and extremities: a new concept. Plast Reconstr Surg. 1991; 87(6):1009–1018.

[20] Saldanha OR, Pinto EB, Matos WN, Jr, et al. Lipoabdominoplasty without undermining. Aesthet Surg J. 2001;21(6):518–526.

[21] Patoué A, De Runz A, Carloni R, et al. Safe monsplasty technique. J Plast Surg Hand Surg. 2018;52(2):74–79.

[22] Mirastschijski U. Classification and treatment of the adult buried Penis. Ann Plast Surg. 2018;80(6):653–659.

[23] Alter GJ. Pubic contouring after massive weight loss in men and women: correction of hidden penis, mons ptosis, and labia majora enlargement. Plast Reconstr Surg. 2012; 130(4):936–947.