Does Thighplasty for Upper Thigh Laxity After Massive Weight Loss Require a Vertical Incision?

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BACKGROUND: After massive weight loss (MWL), many patients present with concerns about skin excess and laxity. The thigh is one of the more complex regions to address in MWL patients because of the differing degree, location, and quality of skin excess and fatty tissue, as well as surgical risk factors.

OBJECTIVE: The authors describe a technique called the anterior proximal extended (APEX) thighlift to effectively treat upper thigh skin excess with a hidden scar while also enhancing adjacent body regions.

METHODS: A review was performed of 97 MWL patients who underwent thighlift surgery between March 1998 and October 2007. Eighty-six women and 11 men, with average weight loss of 146 lb and average body mass index (BMI) at contouring of 29.8, were included in the study. The risk factors that were assessed included age, gender, medical conditions, tobacco use, BMI, weight of skin excised, and surgery performed. The outcomes that were assessed included wound healing and lymphedema. Extended vertical thighlift was performed in 11 patients and anterior superior thighlift in 86 patients.

RESULTS: Complications of thighlift included wound healing problems (n = 18; 18.6%); lymphedema (n = 8; 8.3%); cellulitis (n = 7; 7.2%); seroma (n = 3; 3.1%); and bleeding (n = 1; 1%). On multivariate statistical analysis, age and BMI were found to impair healing in the entire thighlift group. For patients with a BMI greater than or equal to 35, the odds ratio (OR) for a wound healing complication was 13.7 (P = .03). Hypothyroidism was strongly associated with lymphedema, with an OR of 23 (P = .06). Extended thighlift trended toward lymphedema (OR = 16.7; P = .08).

CONCLUSIONS: Thighlift can be a satisfying procedure for both the patient and surgeon because it provides aesthetic improvement in terms of skin excess and laxity. The APEX thighlift is a new technique that expands upon those previously described in the literature to effectively treat upper thigh laxity with a hidden scar after MWL. (Aesthet Surg J; 29:513-523.)

Massive weight loss (MWL) patients, both those losing weight through diet and exercise programs and those who have undergone gastric bypass surgery (GBS), represent a growing population, particularly as weight loss surgery continues to become more safe and effective. Many of these patients present to plastic surgeons seeking to reduce skin excess and laxity resulting from MWL. The thigh is one of the more complex regions to address in MWL patients because of the differing degree, location, and quality of skin excess and fatty tissue, as well as surgical risk factors.

Lockwood1,2 popularized thighlifting in contemporary literature; however, he did not specifically address MWL patients. In his technique, he performed conservative skin resection in combination with undermining and liposuction, and he was able to create a scar hidden in the groin crease. Lifting was accomplished by approximating the superficial fascia of the thigh to Colle’s fascia in the groin, achieving a vertical pull. He incorporated thighlift into his lower body lift, including abdominoplasty and lower backlift. He cautioned against extending the thighlift scar into the infragluteal fold and suggested that surgeons limit skin resection to 5 cm to 7 cm. While he showed great results, the applicability of his procedure to MWL patients was inadequate because of limited skin removal and the risk of scar migration from dependence upon attenuated tissue, leading to the potential risk of labial spread and the subsequent need for revisions.

Because of the limited applicability of the Lockwood thighlift to MWL patients, more surgeons have turned to vertical extended thighlift.3-6 This technique involves the

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removal of medial thigh tissue from the groin to the knee through a vertical incision, converting the axis of pull from vertical to horizontal. There is no reliance on the suspension of tissues that might fail because of attenuation, nor is there limitation of the degree of skin removal, such as that required in patients with significant skin laxity and poor skin quality extending to the knee. In exchange for the dramatic results, the patient receives a visible scar with risk of irregularity in the junction between the anterior and posterior thigh, and the accompanying risks of lymphedema and lymphoceles.3,7,8

While the authors appreciate the greater power of the vertical extended medial thighlift, many MWL patients do not have poor skin quality or exaggerated skin redundancy along the length of the thigh meriting a visible scar with potential injury to venous and lymphatic structures. We have worked to extend the Lockwood medial thighlift to improve its relevance to the MWL population. To that end, we have extended the anterior inguinal crease incision posteriorly into the infragluteal fold with suspension of posterior thigh skin to the ischial periosteum, and have extended the superior portion of Lockwood’s incision to merge into the abdominal incision. Our technique has been named the anterior proximal extended (APEX) thighlift. The APEX thighlift has increased the degree of skin excision and pull beyond that of Lockwood’s technique, while maintaining a scar that is hidden in revealing clothing. A secondary advantage of this technique is improved gluteal aesthetics, which results when skin is removed from the inner thigh and infragluteal area that would otherwise blunt the aesthetic contour of the medial inferior buttock.9,10

METHODS

The operating room census between March 1998 and October 2007 was reviewed, as were the patient database and clinic notes of the primary plastic surgeon (MAS) performing surgery on MWL patients at an academic teaching institution. Ninety-seven patients who had undergone thighlift were identified. Potential risk factors assessed included age, gender, comorbid medical conditions, tobacco use, body mass index (BMI), weight of skin excised, and surgery performed.

APEX thighlift required prone to supine positioning, preferably using spreader bars to allow easier access to the medial thigh. The patient was placed in the prone position (Figure 1, A) and a hemiellipse of skin was removed from the upper posterior thigh, with the superior portion of the incision at the infragluteal crease. Dissection occurred superficial to muscle fascia and subcutaneous tissue was maintained over the ischium. The amount of skin removal that could be performed was assessed and completed. Closure began with approximation of the Scarpa fascia of the thigh to the ischial periosteum, with no. 1 braided permanent interrupted sutures to retain the infragluteal fold and provide strong suspension. The skin was then approximated using dermal closure with buried monofilament absorbable suture and intracuticular suturing with monofilament absorbable suture. The incision was dressed with Dermabond (Ethicon, Somerville, NJ) to provide further strength of closure and protection of the wound. If performed in conjunction with lower backlift and/or outer thigh liposuction, thighlift occurred after backlift and liposuction because preoperative markings may have risen with elevation of the buttoc.

The patient was then carefully turned into the supine position (Figure 1, B). If necessary, completion of the anterior thighlift took place after abdominoplasty because of secondary medial thighlifting with abdominoplasty and the potential need to modify the markings. A continuous incision from the posterior medial closure was created symmetrically along the inguinal crease, or within the lateral mons pubis if there was a large mons that required narrowing. The thighlift resection proceeded from the posterior medial aspect superiorly in a step-wise fashion to avoid overresection. Elevation of the medial
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Thigh skin was performed just under the Scarpa fascia, with avoidance of injury to venous and lymphatic structures; the plane of elevation was superficial. The Scarpa fascia of the thigh was suspended to the pubic periosteum with no. 1 braided permanent suture. The resection continued superiorly along the lateral pubis, leaving a superior triangle (“dogear”) of thigh skin that was excised and blended into the abdominoplasty incision, allowing a second directional axis of pull on the central superior thigh in a more vertical orientation. No drains were used and the anterior skin was dressed with Dermabond (Ethicon, Somerville, NJ); gauze dressings or tape were not necessary. While no liposuction was performed on tissue in the region of resection, lateral thigh liposuction complements this procedure nicely. The preoperative markings and preoperative/postoperative comparison views of the patient featured intraoperatively in Figure 1 can be seen in Figures 2 and 3.

Perioperative intravenous antibiotics were begun before the start of surgery and continued until discharge from the hospital. A urinary catheter was placed at the beginning of the case. We recommended that the patient maintain the catheter for up to five days postsurgery, but the catheter was removed the day after surgery if that was the patient preference. The patient was maintained in thromboembolic deterrent hose and sequential compression devices throughout surgery and until discharge. Prophylactic subcutaneous unfractionated heparin or low molecular weight heparin was administered after surgery. Most patients saw a physical therapist within 18 hours of surgery to ensure satisfactory ambulation.

Outcomes for all techniques were recorded and multiple logistic regression analysis was performed to determine the association between risk factors and complication outcomes. Complications recorded included wound healing problems, lymphedema, cellulitis, seroma, and bleeding. Lymphedema diagnosis was made through a physical examination indicating a swollen calf and may have been identified by the patient. The primary dependent variables included wound healing and lymphedema. Independent variables included age, gender, medical conditions (hypertension, diabetes, hypothyroidism, asthma, sleep apnea, osteoarthritis, cardiac disease, autoimmune disease, reflux disease, thromboembolism, and tobacco use), and weight of skin excised. Statistical analysis was performed in Stata MP (version 10; StataCorp, College Station, TX). \( P \leq .05 \) was considered statistically significant.

Figure 2. A, Preoperative inner thigh crescent markings. The degree of excision is measured with a pinch test and no commitment is made until the surgeon is assured that closure is possible through step-wise excision and closure. B, Inner thigh crescent markings. Also planned is a lower backlift with autologous gluteal augmentation.
The thighlift patient population included 97 individuals (86 women and 11 men). The average age was 39 years (range 22 to 57 years). Existing medical conditions included (alone or in combination): osteoarthritis (n = 13), hypertension (n = 14), reflux disease (n = 10), hypothyroidism (n = 8), asthma (n = 9), diabetes (n = 7), cardiac disease (n = 2), sleep apnea (n = 2), autoimmune disease (n = 2), and venous thromboembolism (VTE) history (n = 1). There were 12 active smokers.

Weight loss was achieved by open (n = 58) or laparoscopic (n = 26) GBS, or diet and exercise (n = 13). The average weight loss was 146 lb. The average

Figure 3. A, C, Preoperative views of a 41-year-old woman who lost 167 lb after laparoscopic gastric bypass surgery, reaching a body mass index of 22.6. She desired a lower body lift. This same patient is featured in Figures 1 and 2. B, D, Two months after thighlift with the anterior proximal extended thighlift (APEX) technique.
Method of weight loss, n (%)

Average weight loss, lb 146
Average BMI at body contouring (range) 30 (21–45)
Age, y, mean (range) 39 (22–57)
Ratio of females:males 86:11

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BMI at contouring was 30 (range 21 to 45), with a standard deviation of 4.78.

Thighlift was performed with an APEX thighlift (n = 86; 89%) or through extended vertical thighlift (n = 11; 11%) technique. Four patients had previous thighlift surgery. Two of these had proximal thighlifts revised with the APEX thighlift; the other two had proximal thighlifts revised with extended vertical thighlift. The average skin resection per thigh was 275 g (range 40 to 980 g). Body contouring procedures included work on the abdomen (n = 86; 99%), back (n = 48; 55%), arm (n = 42; 48%), and chest/breast (n = 25; 29%; Table 1).

The average length of hospital stay was two days. Of these patients, 75 (77.3%) had an uneventful recovery. The average follow-up was 14.8 months (median eight months; range one to 107 months). The following complications occurred and, in some cases, more than one type of complication occurred in patients undergoing thighlift: wounds (n = 18; 18.6%), lymphedema (n = 8; 8.2%), infection (n = 7; 7.2%), lymphocele/seroma (n = 3; 3.1%), and bleeding requiring return to the operating room (n = 1; 1%). Lymphedema diagnosis was based on clinical examination and patient complaint; calf measurements were not taken before and after surgery. In all cases, lymphedema was temporary and responded well to compression hose and elevation, resolving within two months of surgery. There were no thromboembolic complications, confirmed by minimally invasive venous Doppler ultrasound studies in patients with lymphedema (Table 2).

No patients suffered from urinary tract infections from the urinary catheter. There were no problems with labial spread. With the use of large braided nylon sutures for suspension, temporary palpability or discomfort was experienced by some patients. One patient required unilateral removal of a suture at the junction of the pubis and ischium because of continued tenderness. Surgery to remove this painful suture revealed a methicillin-resistant *Staphylococcus aureus* infection. The patient healed well with appropriate oral antibiotic therapy, without subsequent labial spread.

Upon multiple logistic regression analysis (controlling for patient age, gender, BMI, and comorbidities including, diabetes, hypothyroidism, and tobacco use), it was found that age significantly impacted healing complications, with a BMI greater than or equal to 35 showing a trend for wound healing complication. Each one-year increase in age was associated with a 9% increase in risk of a wound healing complication (*P* = .037). There was a trend toward increased risk of wound healing complications for patients with BMI greater than or equal to 35 (odds ratio [OR] = 5.2; *P* = .056; Table 3). Vertical thighlift, hypothyroidism, and male gender showed significant associations with lymphedema. High BMI was less likely associated with lymphedema (OR = 0.62; *P* = .025), which is probably related to the fact that lymphedema is more difficult to diagnose in obese individuals (Table 4).

### DISCUSSION

While MWL has catalyzed growing interest and increased publications regarding thighlift, elements of current concepts (such as vertical thighlifting or Lockwood’s proximal anteromedial technique) may be traced back to earlier literature. Lewis advocated for wide elliptical excision of the medial thigh along the inguinal crease with vertical extension in the 1950s and 1960s. In 1958, Pitanguy performed extensive dermatolipectomy for the correction of trochanteric lipodystrophy and the ptotic inner thigh, bringing an incision from the lateral buttock at the fascia

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**Table 1. Demographic information of the study cohort***

<table>
<thead>
<tr>
<th>No. of patients</th>
<th>97</th>
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<tr>
<td>Ratio of females:males</td>
<td>86:11</td>
</tr>
<tr>
<td>Age, y, mean (range)</td>
<td>39 (22–57)</td>
</tr>
<tr>
<td>Average BMI at body contouring (range)</td>
<td>30 (21–45)</td>
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<tr>
<td>Average weight loss, lb</td>
<td>146</td>
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**Table 2. Thighlift complications**

<table>
<thead>
<tr>
<th>Complication</th>
<th>n (%)</th>
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<tbody>
<tr>
<td>Wounds</td>
<td>18 (18.6%)</td>
</tr>
<tr>
<td>Lymphedema</td>
<td>8 (8.2%)</td>
</tr>
<tr>
<td>Infection</td>
<td>7 (7.2%)</td>
</tr>
<tr>
<td>Lymphocele/seroma</td>
<td>3 (3.1%)</td>
</tr>
<tr>
<td>Postoperative bleed</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Thromboembolism</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Uneventful recovery</td>
<td>75 (77.3%)</td>
</tr>
</tbody>
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APEX, anterior proximal extended thighlift; BMI, body mass index; GBS, gastric bypass surgery.

*Cohort taken from massive weight loss patients who underwent thighlift surgery between March 1998 and October 2007.*
lata across the gluteal fold, ending anteriorly in the medial thigh. This technique was further elaborated upon by Hoffman and Simon.14 Schultz and Feinberg15 described medial thigh lift from the inguinocrural crease to the gluteal crease. Vilain and Dardour16 also used an approach from the anterior medial thigh into the gluteal crease, without suspension.

A review of the literature affords the benefit of borrowing components from various techniques to create an approach that may be individualized and thereby improve upon surgical results for a specific patient population.17,18 The APEX thighlift is the product of such a review and we present a solution for MWL patients who have laxity in the upper half of the thigh and ptosis throughout the lower body. The APEX thighlift takes advantage of the hidden scar described in earlier techniques, using an incision along the medial thigh inguinal crease (or inside that if thinning of a widened pubis is desired) that extends posteriorly into the infragluteal fold (Figure 4). The power of this technique is granted through the lengthened anteroposterior scar and the suspension along both the pubic periosteum and the ischial periosteum at the infragluteal fold, which creates strong reinforcing elevation. Whereas Lockwood’s thighlift technique proved frustrating in patients who have experienced MWL, the APEX thighlift has led to far more satisfying results because of the greater suspension and an increased degree of skin removal. As stated, in these patients, the pelvic periosteal suspension from front to back is what makes this technique more powerful. Earlier in our experience, we saw less successful outcomes and had some problems with scar widening and migration, particularly at the junction of the pubis and ischium. However, with greater attention to proper periosteal suspension, we have seen greater success in outcomes. We now prefer this technique to the one described by Lockwood.

The ideal candidates for APEX thighlift are MWL patients who have a redundancy extending no further distally than the midportion of the medial thigh with good skin quality, and who have a BMI less than or equal to 30 (Figure 5). While patients with significant skin redundancy to the knee and poor skin quality are better candidates for vertical thighlifting techniques, patients understanding the limited distal reach of the APEX lift but who desire a hidden scar are also good candidates. While vertical thighlift after MWL has been well described in the contemporary literature, techniques directed toward MWL patients using a hidden proximal scar have not.3,5,6 Our description of the APEX thighlift fills this void.

We have more recently seen a surge in publications about gluteal aesthetics and contouring. Moving from implants, liposuction, and fat grafting, we are now looking at high-volume fat grafting and vascularized fat and fascia for autologous gluteal augmentation.10 Some authors have also developed an expanded understanding of the elements contributing to an aesthetically pleasing gluteal region, breaking it into aesthetic units for stan-
**Figure 4.** A, Preoperative view of a 46-year-old woman who lost 100 lb after open gastric bypass surgery. B, Six months after lower body lift, including abdominoplasty, lower back lift, and an anterior proximal extended (APEX) thigilift. Her overall buttock aesthetics are markedly improved, with a reduction of the excess tissue of the waist and hip, infragluteal region, and medial thigh.

**Figure 5.** A, Preoperative view of a 49-year-old woman who lost 120 lb after open gastric bypass surgery seven years before this procedure. She also underwent circumferential bodylift and Lockwood thigilift five years before these photographs. She has laxity involving the upper inner thigh. B, Twenty-one months after anterior proximal extended (APEX) thigilift.
Figure 6. A, B, Preoperative views of a 42-year-old woman who lost 135 lb after laparoscopic gastric bypass surgery. Her body mass index at contouring was 27. C, D, Seven months after anterior proximal extended (APEX) thighlift in addition to surgery on her abdomen, lower back, and mastopexy, showing an improvement in the mons, infragluteal regions, and the inner thigh.
A small waist, a flat and well-defined sacral triangle, a contourd lateral thigh, and a reduced inner thigh and posterior infragluteal thigh—in combination with a rounded buttoc—also contribute to an aesthetically pleasing result. The APEX thighlift contributes to an improved aesthetic appearance in the gluteal region of the MWL patient because of the resulting reduction of the inner thigh and infragluteal region (Figure 6). Surgery in adjacent territories, such as the abdomen and lower back, can further contribute to gluteal aesthetic improvement associated with APEX thighlifting. The abdomen, back, and thighlift surgery all complement one another.

Looking at our outcomes analysis, advanced age and BMI greater than or equal to 35 negatively impacted wound healing. We have previously reported on our complications with BMI. Other authors have reported their experience with high BMI impairing outcomes. More advanced age and accompanying hormonal changes have been reported in the literature as detrimental to wound healing. Generally, we approach patients with high BMI (particularly in the morbidly obese range) and older patients with caution, leaning toward more conservative surgical therapy focused on improving function or no surgical therapy at all.

While hypothyroidism, male gender, and vertical thighlift were associated with lymphedema, obesity was less often associated with clinical lymphedema. We have previously reported that hypothyroidism impairs wound healing in an outcomes analysis of MWL patients. There are papers in the literature reporting hypothyroidism as a factor exacerbating lymphedema. The high prevalence of hypothyroidism and the documented effects of hypothyroidism on wound healing and lymphedema make this an area worthy of further focused investigation.

Vertical thighlifting has a known risk of temporary or permanent injury to the venous and lymphatic system, traveling from the knee to the inguinal region. We have seen a greater prevalence of lymphedema in the calf, borne out by our analysis. With careful attention to maintaining the saphenous vein and to remaining superficial to the fascia overlying venous and lymphatic structure, we have found this lymphedema to be temporary and it responds well to conservative management, including compression hose, leg elevation, and a low-salt diet.

The negative relationship between obesity and lymphedema might indicate that higher BMI impairs VTE diagnosis. This is interesting, because more obese patients are increasingly prone to VTE. If there is any suspicion of deep vein thrombosis (DVT)—including calf pain, swelling, or pulmonary embolism with shortness of breath or dyspnea—the possibility of VTE must be ruled out. In the case of workup for DVT, a Duplex scan of the legs is the optimal test, while the best test for pulmonary embolism workup is a spiral computed tomographic scan of the chest.

Patients with a BMI greater than 35 must approach surgery with caution; we tend to discourage thighlift surgery in patients who are still morbidly obese.

Male gender has been reported to be associated with more complications in various plastic surgery procedures, including most (if not all) areas of the body. We found this in a previous outcomes study investigating postbariatric body contouring surgery. In this study, male gender may be associated more with hypertension, varicose veins, greater noncompliance, or other issues that exacerbate lymphedema after thighlift.

CONCLUSIONS

Thigh contouring presents a significant challenge to the plastic surgeon. As more experience is gained with aesthetic analysis of the thigh and its adjacent regions, and as surgical therapeutic options and experience broaden, the outcomes are improved and surgical results are becoming more dramatic. We are also better able to match any number of procedures available to a given presentation, allowing for greater customization in the treatment of postbariatric contour deformities. The APEX thighlift allows us to effectively treat upper thigh laxity with a hidden scar in patients who have undergone MWL.

DISCLOSURES

The authors have no financial interest in and receive no compensation from manufacturers of products mentioned in this article.

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