

Buttocks Fat Grafting: 14 Years of Evolution and Experience

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Background: Fat infiltration for gluteal contour improvement is a procedure that is gaining more advocates. This has caused the application technique and the amount of fat infiltrated to change over time. The authors present their buttocks fat grafting technique evolution that occurred over a 14-year period.

Methods: From April of 1995 to March of 2009, 789 patients underwent liposuction and buttocks fat grafting. Patients were divided into three stages according to chronologic evolution and amount of fat infiltrated.

Results: During the first period (April of 1995 to January of 2004), 120 to 320 cc of fat was infiltrated in the upper gluteal area. During the second period (February of 2004 to February of 2006), 210 to 460 cc of fat was infiltrated in the upper and lower gluteal area. In the third period (March of 2006 to March of 2009), 220 to 1160 cc of fat was infiltrated in the aforementioned areas and in the trochanteric and subgluteal areas. Complications such as fat necrosis, gluteal erythema, infection, and fat embolism syndrome were more frequent and serious in the first stage, despite the authors having infiltrated smaller volumes.

Conclusions: Increasing the volume of fat infiltration in the buttocks has resulted in better contour results in the whole area, and distribution of that larger volume in more extensive areas and in different layers has decreased the index and number of complications. Therefore, to obtain better aesthetic results, it is necessary to keep in mind that these larger amounts must be distributed in larger areas and layers to decrease postsurgical morbidity. (*Plast. Reconstr. Surg.* 128: 545, 2011.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, III.

Fat infiltration in different body areas is a widely accepted procedure.¹⁻¹² Over time, lipoinjection techniques have improved substantially, allowing larger infiltrations in multiple areas.^{1,2,4,13,14} The buttocks are considered a symbol of beauty, and fat infiltration in this area is one of the recourses for improving them.^{4,6,15-18} It is well known that augmentation gluteoplasty with lipoinjection depends not only on the projection and volume in a specific area but also on the correction of proportions in adjacent areas.^{4,6,7,15,19}

There is much clinical evidence of the advantages and the safety and effectiveness of this procedure.^{4,6,8,19-21} This has allowed greater improvement of gluteal contour, because now it is possible to inject larger amounts of fat and also in more extensive areas, including infiltrations in the trochanteric and subgluteal regions. We are presenting our experience in this evolution of buttocks fat infiltration over 14 years. Since our first report,¹ we have made several important changes by modifying the areas and amounts of infiltration to obtain better aesthetic results.

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PATIENTS AND METHODS

A retrospective analysis was performed of all patients who underwent liposuction surgery together with gluteal infiltration over a 14-year period, from April of 1995 to March of 2009. Two

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main changes have been made during these 14 years: the areas that have been injected in the gluteal region, and the amount of fat that has been injected during surgery. The study was divided into three stages according to the infiltrated areas and the evolution of infiltration: infiltration in only the superior gluteal region (stage I), infiltration in the superior and inferior gluteal regions (stage II) and, if necessary, in addition to the above regions, in the trochanteric and/or subgluteal regions (stage III). Patient selection for gluteal lipoinjection is possible only when enough fat can be obtained by liposuction to perform the lipoinjection. Although sometimes there is not enough fat, patients prefer to use the fat obtained by liposuction for buttocks injection instead of discarding it.

When needed, patients were assessed presurgically by an internist, who performed a cardiologic assessment and paraclinical tests. These tests consisted of hematic biometry, prothrombin time, partial thromboplastin time, blood chemistry, and general urinalysis. Diabetes patients had to be fully monitored to undergo surgery. Smokers had to stop smoking 2 weeks before and 2 weeks after surgery.

Surgical Technique

In all patients, preoperative marking is performed with the patient standing. The area to be liposuctioned and the area to be lipoinjected are marked. There are four areas that can be lipoinjected: the upper gluteal area, the lower gluteal area, the trochanteric area, and the subgluteal area. We select the areas to be injected based on standard proportions that have been described for gluteal contour²² and the patient's preference. Most are managed under peridural block anesthesia with lidocaine, except those in whom it was contraindicated, or who underwent multiple procedures. These latter patients were managed under general inhaled anesthesia. Intraoperatively, all patients received 1 g of cephalexin, and one dose was continued every 8 hours for 24 hours, for a total of five.

Liposuction was performed on all patients in the ventral decubitus position with tumescent technique, using 1000 ml of 0.9% saline solution with 1 mg of adrenaline at a temperature of 37°C. There were no anesthetics in the infiltrated solution. The infiltration ratio used was approximately 1.5 cc of infiltrated fluid per 1 cc of material aspirated. Infiltration of the areas to be liposuctioned was performed through incisions in the

intergluteal fold, the superior portion of the posterior iliac crest, and the subgluteal fold. Liposuction was performed with a Cosmetech machine (model SSB-IV; Cosmetech, Alplino, Calif.) and cannulas 3 and 4 mm in diameter, using the same incisions made for infiltration. Depending on the needs of each patient, liposuction of the areas adjacent to the gluteal region was performed, aspirating the lumbosacral region in all cases and placing two silicone drains 2 mm in diameter in these areas, which were removed on the fourth day. These drains were used to prevent fluid accumulation and the formation of seromas.

Aspirated material was collected within the surgical area using sterile bottles. Subsequently, it was placed in a container; a trained nurse adds 300 mg of clindamycin, separates the fibrous tissue from the fat, leaving it to decant, and separates it from the water. Clindamycin was used as a prophylactic antibiotic because of its effectiveness on soft-tissue infections. The fat is cleaned, eliminating all the connective tissue. We do not use any other method to clean the fat; the tumescent solution that is used to do the liposuction serves also to clean the fat. We allow the separation of the lipoaspirated material on fat and liquid, and then we use that fat for grafting. That fat is placed in 60-cc syringes with 3-mm cannulas with three openings, and lipoinjection is performed on the areas marked preoperatively. Depending on each case, infiltration was performed in the superior gluteal, inferior gluteal, trochanteric, and subgluteal areas. The selection of the areas to be injected and the amount of fat to be infiltrated is based on aesthetic proportions described by previous authors²² and by the patient's preference. The decision to finish the lipoinjection during surgery depends basically on the contour obtained and the surgeon's judgment.

Lipoinjection was performed through the opening where liposuction was performed, placing the fat in both the intramuscular and subcutaneous planes. All layers of the subcutaneous plane were injected, whereas intramuscular fat injection was only in the superficial plane. Fat was not injected in the anatomical layers in any specific order. Fat was injected with only retrograde movement of the cannula, avoiding placement of large amounts of fat in a single site and reaccommodating the fat by massaging the gluteal surface. We inject approximately 20 to 30 cc with each retrograde movement. When gluteal elongation is needed, we inject a greater amount of fat in the upper portion and the subgluteal region. This allows us to obtain a better gluteal appearance and

contour. We do not overcorrect fat injection; we try to obtain the desired contour effect during surgery. Palpation and visualization of the gluteal contour are the parameters used to decide the moment of terminating infiltration. Postoperatively, no specific position is indicated. We always combine this operation with liposuction and sometimes with other operations such as abdominoplasty, breast surgery, face lifting, and others, so the postsurgical position depends basically on the operations that have been performed. Patients use girdles for 6 weeks and start therapeutic ultrasound massages three times weekly in the liposuctioned area, starting from day 4 and completing 10 sessions. We do not recommend therapeutic ultrasound for the lipoinjected areas. Patients can return to normal activities 2 weeks after surgery, and we allow exercise 4 weeks after surgery.

Analytic and descriptive statistical evaluation was carried out with the SPSS program, version 17 (SPSS, Inc., Chicago, Ill.), using the chi-square test for the proportional difference between groups, which was statistically significant with a value of $p < 0.05$.

RESULTS

From April of 1995 to March of 2009 (14 years), 789 liposuctions were performed with gluteal fat infiltration on 756 women and 33 men aged 18 to 61 years (median, 31.8 years). The follow-up period for all patients was 3 months to 12 years. All patients included in the study had liposuction and lipoinjection during the same surgical procedure, because liposuction is always necessary to obtain fat for lipoinjection. The total number of patients and ranges of infiltrated volumes in the 14-year period are listed in Table 1.

We divided the study into three stages, according to the areas infiltrated: infiltration in the superior gluteal region (stage I), infiltration in the superior and inferior gluteal regions (stage II), and, if necessary, addition of trochanteric and/or subgluteal regions to these latter two regions

(stage III). The different areas infiltrated according to each stage are shown in Figure 1.

First Stage: Superior Gluteal Region

This stage covered the period from April of 1995 to January of 2004 (8 years 10 months), with a total of 492 patients operated on, of whom 481 were women and 11 were men. The patients were aged between 18 and 61 years (median, 31 years). The follow-up period of patients from this period was 3 months to 12 years, with a mean of 7 years 8 months. Volumes infiltrated ranged from 120 to 320 cc per gluteus. The volume most commonly infiltrated in this stage was 201 to 300 cc, including 298 patients of the 492 total from this period (61 percent) (Table 2). A patient operated on during this stage is shown in case 1 (Fig. 2).

Secondary complications of lipoinjection in this stage were as follows:

1. One patient (0.2 percent) with *Mycobacterium fortuitum* infection treated with a triple regimen of antibiotics leaving aesthetic sequelae in the cutaneous drainage areas.
2. Two patients (0.4 percent) with fat embolism syndrome. In one, abdominoplasty was performed; in the other, breast implants were placed on the same surgical procedure. Both patients began with symptoms 36 hours after surgery when they were at home. Minor liposuction was performed in both cases (1100 and 1900 cc of total fluid aspirated), and both patients showed characteristics of having poor fluid intake after surgery and dehydration secondary to vomiting at home. They were treated with general support measures in the intensive care unit without added complications.
3. Five patients (1 percent) with evident fat necrosis, treated with local puncture and drainage without added complications.
4. Twenty-one patients in 29 glutei (4.2 and 5.8 percent) with gluteal temporal erythema.

Second Stage: Superior and Inferior Gluteal Region

This period was from February of 2004 to February of 2006 (2 years 1 month) and included 132 patients in total, of whom 123 were women and nine were men. Ages ranged from 21 to 49 years (median, 29 years). The follow-up period of patients from this period ranged from 3 months to 4 years 3 months, with a mean of 2 years. Volumes infiltrated ranged from 210 to 460 cc per gluteus. The volume most commonly infiltrated in this

Table 1. Ranges of Volume Infiltrated in Patients between 1995 and 2009

| Volume Infiltrated | No. of Patients |
|--------------------|-----------------|
| 120–200 cc | 174 |
| 201–300 cc | 363 |
| 301–400 cc | 138 |
| 401–500 cc | 67 |
| 501–1160 cc | 47 |
| Total | 789 |

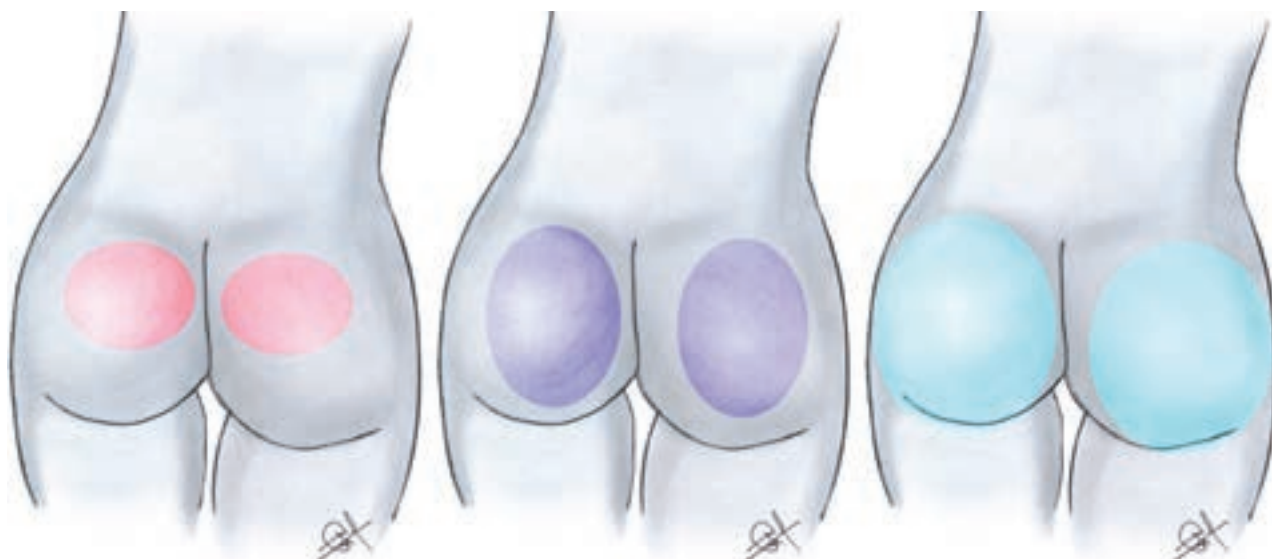


Fig. 1. (Left) Infiltration in only the superior gluteal region (stage I) is shown in red. (Center) Infiltration in the superior and inferior gluteal regions (stage II) is shown in purple. (Right) Infiltration in the previous areas and in the trochanteric and/or subgluteal regions (stage III) is shown in blue.

stage ranged from 301 to 400 cc, including 72 of the 132 total patients from this period (55 percent) (Table 3). Results with infiltration in this stage are shown in case 2 (Fig. 3). Complications of lipoinjection in this stage involved one patient (0.75 percent) with evident fat necrosis and four patients, four glutei (3 percent and 3 percent) with gluteal temporal erythema, who were treated the same way as those of the above group.

Third Stage: Superior, Inferior, Trochanteric, and/or Subgluteal Regions

This period was from March of 2006 to March of 2009 (3 years 1 month), amounting to 165 patients in total, of whom 152 were women and 13 were men. Ages ranged from 22 to 52 years (median, 33 years). The follow-up period of patients from this period ranged from 3 months to 2 years 4 months, with a mean of 14 months. Volumes infiltrated ranged from 220 to 1160 cc per gluteus. The volume most commonly infiltrated in this stage ranged from 401 to 500 cc, on 54 patients of the 165 total from this period (33 percent) (Table 4). Results with infiltration in the entire region are shown in cases 3 and 4 (Figs. 4 and 5, respectively).

The secondary complications of lipoinjection in this stage involved one patient (0.6 percent) with evident fat necrosis and three patients, and four glutei (1.8 percent and 2.4 percent) with gluteal temporal erythema, who were treated as described previously. The complete summary of

the three stages, with infiltrated quantities, averages, and complications, is shown in Table 5.

All patients had improvement of gluteal contour and projection, and there were no noticeable irregularities or asymmetries that required surgical correction. We did not perform any secondary treatment because after the first liposuction, there was not enough fat to perform a secondary lipoinjection. It is important to mention that all the bacterial cultures on the fat necrosis groups during the three stages were negative. Analyzing the incidence of complications in the three groups, there was a statistical tendency for fewer complications in the last group, where more fat was infiltrated in larger areas, compared with the first two groups of the study, where less fat was infiltrated ($p = 0.059$).

Based on fat necrosis and gluteal erythema, which constitute the main evidence for poor graft vascularization, a significant statistical difference was found between groups. In the first group, where less fat was infiltrated in smaller areas, the incidence of erythema and necrosis was significantly larger statistically than in the groups where more fat was distributed in larger areas ($p = 0.0001$ and $p = 0.031$, respectively).

DISCUSSION

Over the past 20 years, plastic surgery has evolved technical techniques for beautifying the gluteal region.^{1,2,4,13,14} Illouz in 1983 was the first to report



Fig. 2. Case 1. The patient underwent infiltration of 220 cc in only the upper part of each buttock. (Left) Preoperative views. (Right) Six-month postoperative views.

Table 2. Ranges of Volume Infiltrated in Patients from April of 1995 to January of 2004*

| Volume Infiltrated | No. of Patients (%) |
|--------------------|---------------------|
| 120–200 cc | 174 (35) |
| 201–300 cc | 298 (61) |
| 301–400 cc | 20 (4) |
| 401–500 cc | 0 |
| 501–1160 cc | 0 |
| Total | 492 |

*Patients in whom only the upper gluteal area was infiltrated.

on liposuction as a technique with which transplantable fat was obtained.¹⁶ Since then, different techniques have been described for managing fat to provide size and shape to the gluteal region^{1,2,4,5,7,14} by the combination of liposuction and fat infiltration, performing it either with fat micrografts or only decanting.^{1,2,4,6,14} Handling fat this way has allowed it to be infiltrated into the gluteal region in quantities ranging from 30 to 210 cc in the first reports, and up to 1000 cc in the most recent ones.^{1,2,4,8,10,13} It is currently described as

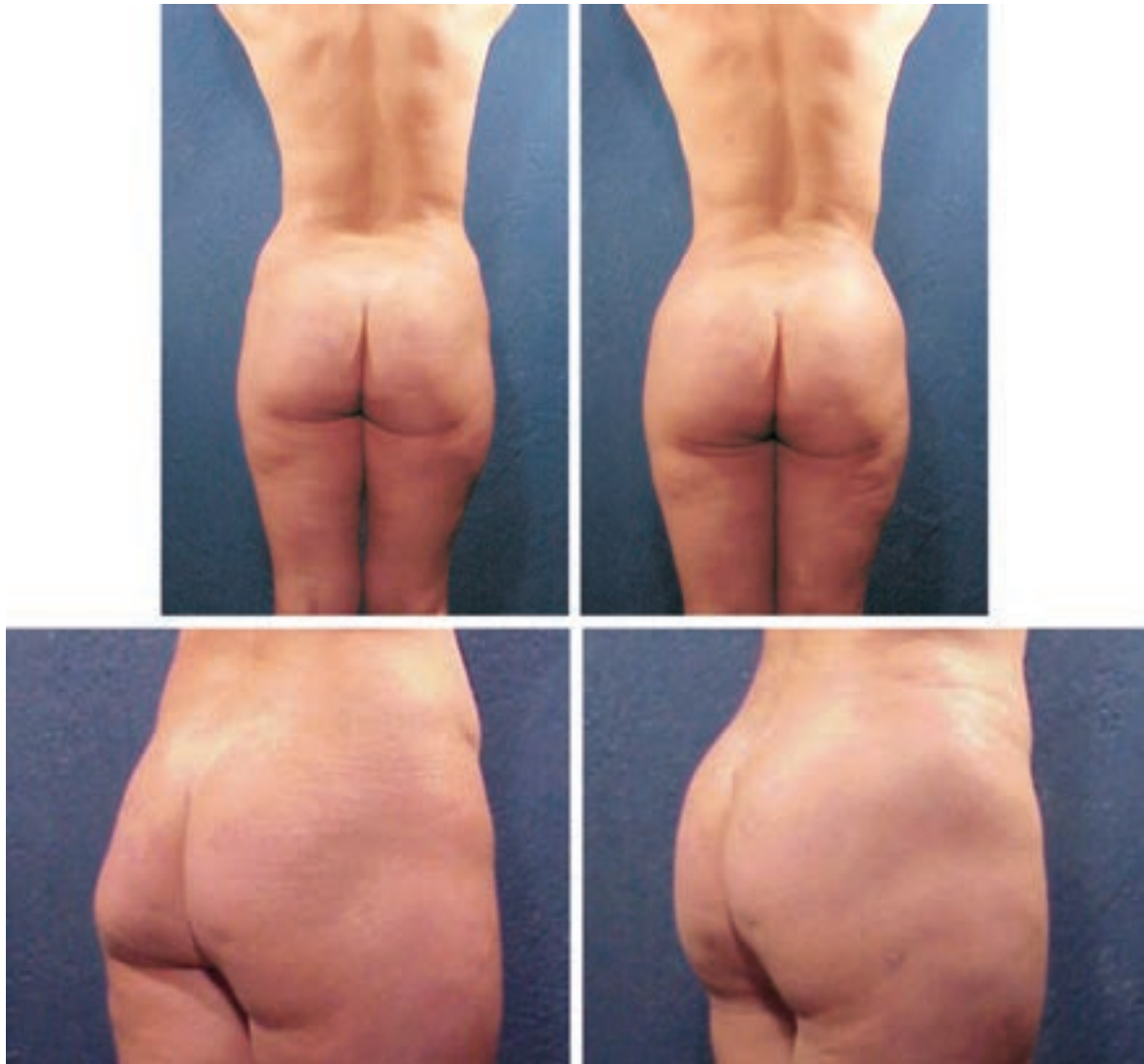


Fig. 3. Case 2. The patient was infiltrated with 400 cc on the upper and lower parts of the buttocks to improve the whole area. (Left) Preoperative views. (Right) Six-month postoperative views.

Table 3. Ranges of Volume Infiltrated in Patients from January of 2004 to February of 2006*

| Volume Infiltrated | No. of Patients (%) |
|--------------------|---------------------|
| 120–200 cc | 0 |
| 201–300 cc | 47 (36) |
| 301–400 cc | 72 (55) |
| 401–500 cc | 13 (10) |
| 501–1160 cc | 0 |
| Total | 132 |

*Patients infiltrated in the upper and lower gluteal areas.

one of the techniques with the least risk of complications in gluteal augmentation.^{10,20}

During our 14 years of experience infiltrating fat, we have maintained the same surgical technique; the only variation has been the amount of fat injected and the areas treated. We decided to

add different anatomical areas to be injected because we had noticed two problems. We noticed that when we injected a large amount of fat in a small area in the attempt to obtain better results, erythema and fat necrosis appeared more frequently. We also saw that injecting fat in only one or two areas was not enough to obtain a good aesthetic contour in some patients, because there were patients whose buttock shape needed to be improved in several areas.

We do not recommend overcorrection with fat injection. It is better to try to obtain the desired contour during surgery than to overcorrect. We emphasize that injecting a large amount of fat in a single area and in a single layer is the main cause of local complications and fat necrosis. If we remember the behavior of fat transplantation, we



Fig. 4. Case 3. The patient required fat infiltration on the hips and upper and lower gluteal regions. This was necessary to equilibrate the hips with the rest of the buttocks; 500 cc was injected on each side. (Left) Preoperative views. (Right) Six-month postoperative views.

Table 4. Ranges of Volume Infiltrated in Patients from March of 2006 to January of 2009*

| Volume Infiltrated | No. of Patients (%) |
|--------------------|---------------------|
| 120–200 cc | 0 |
| 201–300 cc | 18 (11) |
| 301–400 cc | 46 (28) |
| 401–500 cc | 54 (33) |
| 501–1160 cc | 47 (28) |
| Total | 165 |

*Patients infiltrated in the upper and lower trochanter areas and/or subgluteal area. The largest number of patients infiltrated in this period is marked.

can understand this. When fat tissue is injected, the survival of fat cells depends on adequate revascularization. To achieve an adequate blood supply to fat cells, it is necessary to allow the best possible contact between the fat injected and the host tissue. If fat is injected in large amounts in a single layer, a lot of fat tissue is not going to receive an adequate blood supply, especially fat that is situated on the central portion of the graft. This fat is going to suffer several degrees of necrosis.



Fig. 5. Case 4. The patient underwent fat infiltration of the hips, upper and lower gluteal regions, and on the subgluteal region. This was necessary to elongate the buttocks. (*Left*) Preoperative views. (*Right*) Postoperative views taken 2 years after surgery, with 1100 cc injected on each gluteal region and 1 month after a secondary liposuction.

In contrast, when fat is injected in different anatomical layers, it is possible to provide better vascularization to fat cells because fat is not concentrated in a single anatomical space and is surrounded by vascularized tissue. This provides the option of injecting a larger amount of fat than before. In our first stage, we had more problems with erythema and fat necrosis because a large amount of fat was injected in a small area and in a single layer.

In the analysis of our 14-year study, we observed that there is a considerably significant increase in the volume of infiltration, which is attributable not only to the evolution in handling fat but also to the increase in the infiltrated area. Increasing the area to be infiltrated has allowed us to infiltrate larger amounts of fat, but the most important factor is that it has allowed us to mold the different gluteal areas more aesthetically. Proper assessment of the different gluteal regions

Table 5. Three Stages from April of 1995 to January of 2009*

| Stage | Period | No. of Patients | Area Infiltrated | Volume Infiltrated (cc) | | | | | | Fat Necrosis (%) | Gluteal Erythema (%) | Fat Embolism Syndrome (%) | Mycobacterium fortuitum Infection (%) |
|-------|--------------------------------------|-----------------|--|-------------------------|---------|---------|---------|----------|----------|------------------|----------------------|---------------------------|---------------------------------------|
| | | | | 120-200 | 201-300 | 301-400 | 401-500 | 501-1160 | | | | | |
| I | April of 1995- January of 2004 | 492 | Upper buttocks | 174 | 298 | 20 | 0 | 0 | 5 (1.01) | 21 (4.26) | 2 (0.40) | 1 (0.20) | |
| II | January of 2004- February of 2006 | 132 | Upper and lower buttocks | 0 | 47 | 72 | 13 | 0 | 1 (0.75) | 4 (3.03) | 0 (0) | 0 (0) | |
| III | March of 2006- January of 2009 | 165 | Lower and upper buttocks, trochanter and/or subgluteal | 0 | 18 | 46 | 54 | 47 | 1 (0.60) | 3 (1.81) | 0 (0) | 0 (0) | |
| Total | | 789 | | 174 | 363 | 138 | 67 | 47 | 7 (0.88) | 28 (3.54) | 2 (0.25) | 1 (0.12) | |

*Complications and volumes infiltrated.

(i.e., superior, inferior, trochanteric, and subgluteal) is a factor of vital importance for obtaining the desired result. In the first stage of our study, the superior gluteal region was the only area where infiltration was performed, which limited our volume of infiltration. At the same time, it resulted in a higher morbidity rate, because when attempting to infiltrate significant quantities of fat into a single region, the complications were more numerous. This was the stage with the highest rate of complications (5.89 percent) and with the most severe complications.

In the second stage, we started infiltration of both the superior and inferior regions, which allowed us to increase the volume of fat infiltration. No increased morbidity was seen, and there was improvement in the results, with the rate of total complications being 3.78 percent. However, alterations in the contour of the trochanteric region that are commonly seen were not corrected. For that reason, we believed that infiltration of the trochanteric region should form part of this procedure when necessary. Likewise, in cases where a longer gluteus was required, fat infiltration into the subgluteal region was a good alternative for solving it. Therefore, in the third stage, we started fat infiltration in the trochanteric region and in the subgluteal region, when necessary. We were thereby able to correct alterations of the trochanteric region, lengthening the gluteus, and increasing volume and projection by infiltrating all these regions, and increasing the volume infiltrated at the same time. When correcting these types of alterations, we observed that fat infiltration in more extensive areas is more important than the amount of fat infiltrated. Analyzing the data from our study, we can point out that in the period from 1995 to 2004 (9 years), the amounts infiltrated fluctuated from 201 to 300 cc. Meanwhile, from 2004 to 2009 (5 years), the amounts infiltrated in patients reached up to 1160 cc. Therefore, the increase in quantities of fat has risen vertiginously, with the main factor being fat distribution in more areas.

As for secondary complications of lipoinjection, seven patients (0.88 percent) developed fat necrosis manifested by persistent erythema and fluctuation in the area. This was managed by a puncture, draining thick fluid material in variable amounts. Gram staining and wound secretion cultures were negative, and were treated with broad-spectrum antiinflammatories and antibiotics (quinolones) as prophylaxis for 7 days. It is important to note that five cases occurred in the first stage and only one in each of the following stages, significantly decreas-

ing the percentage. In 37 glutei (4.6 percent) of 28 patients (3.5 percent), there was gluteal temporal erythema that appeared between the fourth and fifth days after surgery and was managed with conservative measures such as hot compresses, anti-inflammatory drugs, and cephalosporin-type antibiotics, with no subsequent sequelae. One patient (0.1 percent), 2 months after surgery, started with erythematous areas in one buttock, which was resistant to management with the usual antibiotics (cephalosporin and later quinolones). Drainage was performed through small incisions and, after culture, *Mycobacterium fortuitum* infection was diagnosed. After diagnosis, it was managed at the place of origin with a triple regimen of antibiotics and resolved without major sequelae to the scars in the areas where drainage of the material was performed.

Two patients (0.2 percent) presented fat embolism syndrome, and both cases were managed in intensive care units. The symptoms were quite similar and appeared between 48 and 72 hours after surgery and resolved within 1 week of support therapy management. It is important to mention that in both patients, the amount of aspirated material and the fat lipoinjected was very small, but both had important dehydration after surgery. Similar cases have been reported²³ where dehydration has been present in fat embolism syndrome. Dehydration can produce blood concentration, including fat concentration that has not been eliminated totally from the circulatory system after liposuction and/or lipoinjection. That is why we recommend significant fluid intake after surgery to prevent blood concentration.

The complication rate has decreased in spite of the increased amount of fat infiltrated. Fat necrosis and secondary irritation of infiltrated fat were the most common complications in our patients; in the period from 1995 to 2004, we had 5.2 percent (26 patients) of the 492 cases operated on between these dates, dropping to 3 percent (nine patients) of the 297 cases operated on from 2004 to 2009. We attribute this to the fact that when there is a larger distribution area, the fat is integrated more evenly, without presenting a high rate of liquefaction. This indicates that adequate distribution of infiltrated fat is important, in the different depths and in the different areas of the gluteus. We noticed no different absorption rates between the various areas that were lipoinjected, but we perceived that the infiltrated area changed with patients' weight fluctuations. If the patient gained weight, the buttock increased, and if the patient lost weight, there was a decrease in

the buttock, although these variations were not significant.

CONCLUSIONS

The glutei are considered a symbol of beauty, and fat infiltration in this area is one of the recourses for improving them. Fat infiltration has increased significantly in quantity, which is attributable not only to evolution in the handling of fat but also to the fact that infiltrated areas have increased and fat has been better distributed, on the surface and in the infiltration planes. A larger amount of fat infiltration in more extensive areas has allowed molding the gluteus more appropriately. Complications have decreased despite increasing the amount of fat infiltrated; this is because fat being distributed in a more extensive area and in different layers permits better revascularization, allows better fat integration, and diminishes fat necrosis. Our experience has allowed us to maintain the same technique over the years, obtaining better results and fewer complications.

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