Augmentation Gluteoplasty: A Brazilian Perspective

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Summary: According to recent data, augmentation gluteoplasty continues to gain popularity in the United States and globally, especially in procedures involving fat grafts. However, serious concerns about its safety have been raised over the past 2 years. Will this trend continue or has it already reached its peak? The answer depends on how the technique is going to be performed hereafter. In this article, the following seven learning objectives for performing gluteal augmentation safely and effectively are covered: (1) the concept of what is a beautiful buttock and how to select the patients who will have better outcomes; (2) diagram each patient’s needs for liposuction and graft; (3) use maneuvers for contouring and projection; (4) compare specific indications for fat graft and gluteal implants; (5) evaluate ptosis grade to indicate whether volume repositioning is sufficient; (6) formulate care protocols for risk management; and (7) develop lasting and high-satisfaction-rate results. It is pivotal to recognize each patient’s body characteristics and ability to achieve a good result, and to work on her expectations preoperatively and accordingly to perform the procedure in the safest manner possible. (Plast. Reconstr. Surg. 142: 910, 2018.)

HISTORY OF BUTTOCK FAT GRAFTS

According to the latest American Society of Plastic Surgeons¹ and American Society for Aesthetic Plastic Surgery² data, augmentation gluteoplasty continues to gain popularity in the U.S. International Society of Aesthetic Plastic Surgery data also confirm that buttock augmentation is a fast growing trend globally.³ In 2014, nearly 40 percent of augmentation gluteoplasty cases were performed in Brazil.³ Although the United States and Europe doubled their contribution since then,³ Brazil is still a reference country in buttock augmentation because most of the procedures (26 percent of the total procedures worldwide in 2016) are performed here, and these procedures have now been performed for 30 years in the country.³ Will this trend continue or has it already reached its peak? The answer depends on how future procedures will be performed.

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CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, V.
WHAT IS A BEAUTIFUL BUTTOCK?

According to Singh, an attractive woman should have an hourglass figure and a waist-to-hip ratio of approximately 0.7. These characteristics matter more than body mass index for attractiveness. This finding is universal, being observed in most cultures and economic backgrounds, and is constant throughout history, where many ancient cultures depict women with the 0.7 waist-to-hip ratio. In a recent survey with respondents from around the world, Heidekrueger et al. confirmed the 0.7 waist-to-hip ratio as the most desired.

In a population assessment study, with 93 percent of the respondents from the United States, Wong et al. showed that the most desirable waist-to-hip ratio in the lateral view was also 0.7, with the posterior prominence positioned at the buttocks’ midpoint. In the posterior view, the most attractive lateral prominence position was at the inferior gluteal fold. Regarding attractiveness, another lateral view landmark is the lumbar curvature, shown by Lewis et al. as optimal when the angle between the vertical body and sacral bone axes (buttocks’ upper part) is 45 degrees.

Roberts and colleagues analyzed buttock characteristics of each ethnic group. Brazil is one of the few countries where there was a true ethnic mixture, giving rise to buttocks with different characteristics, including those that met the criteria to qualify as a beauty standard for buttocks.

APPROPRIATE PATIENT SELECTION

Almost every patient is eligible to undergo this procedure, but excellent results depend on the presence of proper patient characteristics. The first characteristic is the body fat percentage: when it is low (<20 percent), patients do not have enough fat, so we use prostheses. If the fat percentage is high (>30 percent), patients need to lose weight to diminish the fat and exercise to increase the amount of muscle. However, when the percentage is between 20 and 30 percent, we have the ideal scenario to obtain excellent results just with fat.

The second characteristic is the amount of fat available, which is the body mass index. If the body mass index is under 20 kg/m², we use a prosthesis because of the absence of fat. If it is above 30 kg/m², the patient has too much fat. For security reasons, the Brazilian government released a law limiting the liposuction volume to 7 percent of the ideal weight. Thus, for a good result, the patient needs to lose weight. If the body mass index is between 20 and 30 kg/m², we can safely remove the excess fat, enough to obtain an excellent result.

The third consideration is that bodies are sculpted with fat hanging on a bony framework. Thus, if it is too flat, it will not have the support to build curves, such as in “banana” or “apple” body shapes. In these cases, we try to lower the patient’s expectations preoperatively.

Lastly, all these fats will be covered by the skin, which should be present in an adequate amount and with good elasticity. When there is excess skin, such as in massive weight loss patients, the results are not optimal with isolated augmentations, with either fat or implants. Massive weight loss patients require additional skin excision procedures, which are a subject of another study. Choosing the right candidate (low body fat percentage, low body mass index, pear or hourglass body shape, and no excess skin) leads to better outcomes with minimal morbidity while being conservative and primarily working with fat graft.

DIAGRAM EACH PATIENT’S NEED FOR LIPOSUCTION AND GRAFT

The grafted area is located mainly between the sacrum lateral border, iliac wing, and femoral neck and over the gluteus maximus and the fossa between the maximus, medius, and tensor fasciae latae. The area to be grafted usually is oval in shape, slightly displaced above (to lift) and laterally (to fill and complete the lateral curve). Moreover, it is advisable to graft the depression over the greater trochanter until it turns flat. The area to be suctioned involves the upper torso, flanks, sacrum, and occasionally the saddlebags and inner thighs. The transition zone is seagull-like, beginning in the intergluteal cleft apex, and is not touched (Fig. 1).

MANEUVERS FOR CONTOURING OR AUGMENTING PROJECTION

We prefer to operate under epidural anesthesia because of its proven beneficial effect in preventing thromboembolic events. We administer antibiotic prophylaxis and infiltrate with a solution of 0.9% saline and epinephrine 1:500,000, in the same amount we plan to suction. We avoid using local anesthetics because there are some reports that it can impact adipocyte viability and the neural block prevents pain.
The technique used was as follows. (See Video, Supplemental Digital Content 1, which demonstrates the operative technique and maneuvers used for gluteal contouring and projection augmentation through autologous fat grafting, available in the “Related Videos” section of the full-text article on PRSJournal.com or, for Ovid users, available at http://links.lww.com/PRS/C979.) We perform the liposuction from as few ports as possible. In the trunk, usually two ports are used: one in the bra line for the upper trunk and waist, and the other at the apex of the intergluteal cleft in a fan-shape fashion. In these areas, we try to suction all the fat that we can. From the intergluteal cleft, we aspirate fat in the sacrum and flank using a gentle pressure with the palm of the hand over the area. We try to suction in a crisscross manner toward the other port’s areas. From the port of each infragluteal fold, we suction the fat from the saddlebags, but deeper than that in the trunk to avoid visible superficial irregularities, until we get a continuous line starting in the lateral knees. From the same port, we suction the subgluteal fat in the posterior thighs, pressing it with our fingers. Finally, we move the cannula medially to suction the inner thighs, with the skin spread by the assistant, while we press the area with our whole hand.

Ozsoy et al.\textsuperscript{20} showed that adipocyte viability increases according to the diameter of the cannula used in suctioning up to 4 mm and in grafting up to 2.5 mm. Erdim et al.\textsuperscript{21} confirmed these
findings, but added a 6-mm cannula, with increasing and proportional adipocyte viability. For this reason, we prefer to use 4- and 5-mm cannulas during harvesting.

The lipoaspirate decants for almost 30 minutes, while the liposuction is being performed, to separate the supernatant fat from the underlying liquid in a glass container with a closed circuit, and opening it only when it is time to graft. Strong et al.22 showed that no significant difference in retention between centrifugation, filtration, or sedimentation or even between different donor sites exists. Sinno et al.23 showed that no difference exists between washing and centrifuging, but showed that low-shear devices maintain fat structural integrity, which is important for the fat filling effect.

With the patient in the prone position, the fat is grafted superficially to give contour and shape, beginning laterally in multiple planes, delivering small amounts of fat in each pass of the 3.5-mm cannula. After the most lateral part is filled, we begin to fill toward the middle. If the medial buttoc is hypoplastic, we inject fat even near the intergluteal fold but always in the subcutaneous plane. Eventual lumps of fat are spread by pressing the fingers over them. The amount of grafted fat for each case is determined visually, filling from lateral to medial and injecting in a fan-shape manner. Only the intergluteal port is used to graft the fat, in order to do it in a centrifugal mode.

Finally, the fat is grafted deeper, toward the lateral part of the gluteal muscles, to increase its projection, but keeping the cannula parallel to the plane of the sacrum with an angle less than 30 degrees to avoid injecting too deeply. Approximately 20 to 30 percent of the fat is spared for deeper grafts. Deeper grafts toward the central parts are never performed, to avoid damage or pressure on the gluteal vessels. When graft is placed laterally into the muscle, the fat naturally spreads along the muscle fibers toward the central part but without pressure or vessel embolism.

Cannulas with an internal diameter of approximately 3 mm are preferred because the classic theory of lipograft survival published by Carpaneda and Ribeiro24 in 1993 and the recent substitution theory25 agree that fat threads should have, at most, a 1.5-mm radius to achieve long-term retention. Toledo published his 30-year experience,26 showing that injecting 500 cc in each buttock is enough to achieve a good result while keeping the complication incidence very low. Interestingly, this amount is exactly the average volume we injected. We agree that when a patient needs much more than that, which is unusual, a second procedure is advisable.

Murillo27 and Wolf et al.,28 using magnetic resonance imaging, showed a fat reabsorption rate between 20 and 36 percent, although the fat was injected completely inside the muscle. Swanson29 evaluated retention of fat injected in the subcutaneous plane through ultrasound scans and found a mean 33 percent reabsorption rate.

**COMPARISON OF FAT GRAFTS AND GLUTEAL IMPLANTS**

The prosthesis, because it is placed inside the gluteus maximus muscle, gives volume mainly to the medial part with other areas empty. Thus, prosthesis boundaries are sometimes visible with an unnatural appearance, even when placed inside the muscle.

Fat grafts are not restricted to muscle anatomy and can be used wherever they are needed, especially on lateral depressions. A gluteal implant is a good choice when there is no fat to harvest, such as in patients with a low body mass index and low fat percentage, or when there is not enough fat to receive all the grafted volume, such as in male patients or those with vaccine scars that promoted fat resorption and fibrosis (Table 1).

Our approach to gluteal implant placement follows Gonzalez’s XYZ intramuscular technique30 because of its lower incidence of complications. We make a 0.5-cm-wide and 6-cm-long fusiform skin incision along the intergluteal fold and incise the subcutaneous tissue at 45 degrees to preserve the sacral cutaneous ligament that will be deepithelialized and separated during wound closure to remake the fold. Once fascia is exposed, we incise it along the muscular fibers, undermining with the index finger to reach the middle of the muscular mass. From this point, a blunt dissector opens the implant pocket without direct vision. After introduction of the implant, we suture all layers.30

A multicenter review31 involving experienced gluteal augmentation surgeons reported a 38.1 percent rate of total complications with prosthesis use. A systematic review by Sinno et al.32 showed complication rates of 21.6 percent with implants and 9.9 percent with fat grafts. A meta-analysis by

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<th>Table 1. Indication for Gluteal Implants*</th>
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BMI, body mass index; BFP, body fat percentage. *Situations where there is no fat to harvest or there is not enough fat to embrace all the grafted volume.
Condé-Green et al.\textsuperscript{33} showed a 7 percent complication rate using fat graft.

Interestingly, in our practice, patients are progressively avoiding the implant option. For example, 28.6 percent of gluteal augmentations were performed with implants in 2011, but this proportion continually dropped and was 4.5 percent in 2016. Nowadays, patients who were classic candidates for prosthesis (Table 1), but refuse it, prefer to undergo two rounds of fat grafting to achieve the desired projection (Fig. 2). [See Figure, Supplemental Digital Content 2, which shows a 21-year-old patient with a low body mass index who was a classic candidate for a prosthesis but refused it. She was advised that probably two rounds of fat grafting would be required. First, 660 cc was injected into each buttock; after 6 months, an additional 360 cc was grafted, achieving the result she wanted without implants (left, preoperatively; right, 1 year postoperatively), http://links.lww.com/PRS/C980.]

![Fig. 2. A 22-year-old patient with a low body fat percentage who did not want implants. First, 500 cc was injected into each buttock and, because she still wanted more volume, a second round was done and 540 cc was injected into each side (above, preoperatively; below, 5 years postoperatively).](image-url)
**BUTTOCK PTOSIS**

The lateral length of the infragluteal fold measures the degree of buttocks ptosis. Ramanadham and Rohrich showed that, in the face, volume is lost and the tissues sag down toward the central line as we age, producing jowls and marionette lines, which are signs of an aging face. The treatment should not focus on the central and lower parts; otherwise, it would worsen the appearance. Volume should be restored toward the upper lateral regions to give a youthful appearance.

The same principles apply to the ptotic buttocks. If the ptosis is mild to moderate, its appearance can be improved by restoring the volume toward the upper lateral regions (Fig. 3). If the degree of ptosis is moderate to accentuated, such

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**Fig. 3.** A 26-year-old patient with a body mass index of 21.2 kg/m², and with an appearance of a buttock detached from her flanks and mild buttocks ptosis, was subjected to buttocks fat grafting with 420 cc into each side. This case exemplifies how we can diminish the length of the infragluteal fold and consequently the degree of buttocks ptosis by restoring volume toward the upper lateral regions, delivering a more youthful appearance, with a continuity of her torso lines (above, preoperatively; below, 3 years postoperatively).
as in the face, an excisional procedure needs to be performed to pull up the tissues.

**FORMULATE CARE PROTOCOLS TO MANAGE THE RISKS**

Between January of 2011 and January of 2016, our group (three surgeons) performed 845 buttock fat grafts, either isolated or combined with anterior procedures, in patients with a mean age of 34 years, a mean body mass index of 25 kg/m², and a mean volume of 498 cc grafted into each side. With regard to minor complications, 4 percent had sacral seromas and none had an infection or fat necrosis. Major complications included two cases of deep vein thrombosis confirmed by Doppler scan; two cases of pulmonary thromboembolism confirmed by computed tomographic angiography, in which the symptoms appeared 7 and 9 days postoperatively (fat embolism appears in the first 48 hours); and symptomatic hypovolemia requiring intravenous hydration in 8 percent of the cases. No deaths have been reported since 1989.

Preoperatively, oral contraceptive or hormone intake is interrupted for 30 days, and aspirin intake is interrupted for 7 days. If the patient needs to lose weight, she is advised to rely on exercises and not on diets, to avoid anemia and low-protein conditions. Laboratory tests, electrocardiography, and abdominal wall ultrasound scan to rule out hernias are requested.

Cárdenas-Camarena et al. reported 21 deaths related to intramuscular lipoinjection, which led us to conclude that injections into deep muscle planes should be avoided. This fatal complication has also occurred in California, Florida, and Brazil. Thus, there are reports of deaths related to fat embolism in all countries were most buttock fat grafts are performed according to International Society of Aesthetic Plastic Surgery. We proposed the following “BRAZIL” safety maneuvers to avoid mortality in patients:

**B. Blunt:** Use only blunt cannulas with at least 3-mm internal diameter attached to low-pressure syringes.

**R. Retrograde:** Infiltrate in a retrograde fashion, always from the highest and most superficial point, the intergluteal crease, in a centrifugal orientation, and with slow movements to prevent vessel damage.

**A. Abundant:** Keep the patient well hydrated with a urinary output between 1 and 2 cc/kg/hour throughout the first 24 hours to diminish the need of the vessels for external fluids and to dilute small amounts of fat eventually aspirated.

**Z. Zone:** Avoid injecting deeper into the danger zone, which is a pyramidal area with its apex between the sacral dimples and its base along the medial two-thirds of the infragluteal fold, on both sides. This area begins from the sacral bone apex, passes through the ischial spine, and reaches the femur in the subgluteal fold. Within this area, all major vessels are located in the gluteal region, except the superior gluteal artery and vein, which are very deep and high in the iliac wing inferior edge (Fig. 4).

**I. Implant:** In patients who lack subcutaneous tissue that could lead us to inject mainly into the muscle, and do not accept a second procedure, we prefer to use prostheses inside the muscle and fat only in the subcutaneous plane.

**L. Larger:** Prioritize contour by injecting the larger part into the subcutaneous layer first. Set apart 20 to 30 percent to inject inside the lateral part of the muscles for projection.

Massive fat embolisms occur if free fat and damaged vessels with negative pressure are inside. If subcutaneous injection is prioritized, there will hardly be vessels large enough to suction a great

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**Fig. 4.** Danger zone: superficial (left) and bone (right) landmarks. The danger zone for deep fat graft in buttocks has a nearly pyramidal shape, with its apex in the middle point between sacral dimples. Its base goes along the gluteal fold, compromising the thighs’ medial two-thirds. The lateral lines connect the apex to its base passing over the ischial spine.
amount of fat into the lungs. Rodríguez-García et al.\(^4\) published an anatomical study of the gluteus maximus showing that it had only 3 cm of thickness at most. If cannulas are not kept parallel to the sacrum’s surface, chances are that they are accessing the submuscular plane, where large vessels and nerves are present. Recent anatomical studies in cadavers by Ramos-Gallardo et al.\(^4\) confirmed our danger zone, published 2 years ago,\(^4\) by showing that more lateral injections inserting the cannula at the intergluteal crease and with an angulation less than 30 degrees place the fat away from major vessels, with no colorant around them. Usually, there is an involuntary and subtle muscle contraction when the cannula perforates the outer fascia of the gluteal muscles, but certainty this is achieved only using ultrasound intraoperatively.

Fig. 5. Gluteal fat graft associated with anterior procedures in a 25-year-old patient with a body mass index of 20.6 kg/m\(^2\), subjected to augmentation mastopexy (255-cc implants), miniabdominoplasty, liposuction (3 liters), and gluteal augmentation with 540 cc into each side (above, preoperatively; below, 1 year postoperatively, showing no compromise of fat graft survival).
Compression socks and garments are used from the end of the procedure until 1 and 2 months, respectively. Starting at the recovery room, patients rest over their buttocks. Pereira and Radwanski showed in 1996 that, clinically, one can associate anterior procedures while letting the patient lie over her buttocks without jeopardizing the graft. Most of our buttock augmentations are performed with abdominoplasties, breast reductions, or breast augmentations without jeopardizing the effectiveness and satisfaction of the procedure (Fig. 5).

A possible explanation for why pressure over the graft does not affect it is based on the Pascal principle, whereby pressure sores are prevented by using an air or liquid mattress (i.e., when an enclosed liquid is subjected to an external force, this force will be broken into several small forces spread all over the enclosed surface). Thus, when we enclose the grafted fat using compression garments, the force applied by lying over the buttocks will be broken into several minor forces that are not strong enough to prevent graft survival.

Evidence about pressure and fat came to light in 2013, when Lee et al. showed that pressure up to 6 atm did not affect graft viability, but slow injections with low shear stress significantly increased viability. Banyard et al. showed that mechanical forces actually modulate progenitor phenotypes associated with pluripotency, adding the regenerative benefits to the traditional lipofilling effect of fat grafts.

According to the latest deep venous thrombosis risk factor assessment, because of the association with other procedures, such as tummy tuck or breast surgery, most of our procedures last more than 3 hours, which represents at least five points of the Caprini score, putting the patient at the highest risk level and requiring the complete prophylaxis regimen. Consequently, patients remain with intermittent pneumatic compression for 12 hours, and 40 mg of low-molecular-weight heparin is administered subcutaneously daily for 7 days.

We encourage patients to ambulate as soon as possible, drink plenty of liquids (approximately 4 liters per day) during the first week, and maintain the urine clear. Massages over the grafted area are avoided.

CONCLUSIONS

To develop lasting results with high satisfaction rates in augmentation gluteoplasty, surgeon-related factors (e.g., multiple tunnel injections and fat lake avoidance) and patient-related issues (e.g., maintaining weight, use of compression garments around the buttocks, and avoidance of massage over the graft) should be considered. Finally, satisfaction is a balance between what we can give and what the patient expects from the procedure. Thus, it is important to recognize each patient’s body characteristics and ability to achieve a good result and work on her expectations preoperatively and accordingly to perform the procedure in the safest manner possible.

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