Buttocks Augmentation

6

Introduction

The popular media has put a premium on particular physical attributes that are attractive, and none of these have been more prominent in the last two decades than the buttocks. Stars such as Shakira, Jennifer Lopez, and Kim Kardashian have been revered for their round, plump bottoms (Figs. 6.1 and 6.2). Cultures such as those in South America, which openly display the human form, have increasingly sought ways to contour the gluteal region as it is considered a very important secondary sexual characteristic. To that end, many patients present to aesthetic practices for augmentation of the buttocks, in the hope of making them look shapelier. In 2006, according to the American Society for Aesthetic Plastic Surgery, 2,556 gluteal augmentations were performed in the United States [1]. When considering the patients that are undergoing buttock augmentations, the vast majority of patients are in the 20–39-year age group [2, 3]. Whether fat grafting to the buttocks or implant placement is the right choice for the patient is at the discretion of the surgeon based on physical findings at the time of consultation. Herein, we will discuss the evaluation of the gluteal region, discuss the gluteal augmentation procedure, and recommend the patients that are best suited for implant surgery versus other options.

Fig. 6.1 Jennifer Lopez

N.V. Chugay et al., *Body Sculpting with Silicone Implants*,
DOI 10.1007/978-3-319-04957-1_6,

Fig. 6.2 Kim Kardashian

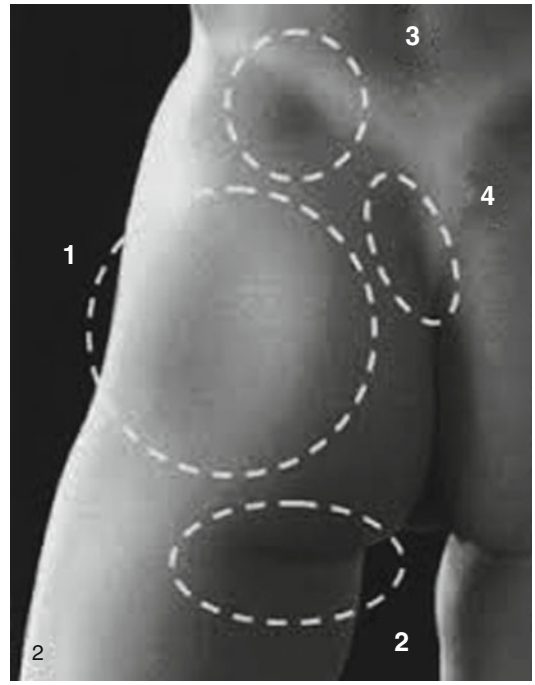


Fig. 6.3 Cuenca-Guerra Buttock Landmarks. Take note of the following: *1* A mild lateral depression that corresponds to the greater trochanter of the femur. *2* Short infragluteal folds that do not extend beyond the medial two-thirds of the posterior thigh. *3* A well-defined dimple on each side of the medial sacral crest that correspond to the posterior-superior iliac spines (PSIS). *4* A V-shaped crease (or sacral triangle) that arises from the proximal end of the gluteal crease

Gluteal Aesthetics and Classification Systems

Although the standards to define a beautiful buttock region may vary slightly from culture to culture, there is little debate about the allure of the hourglass female figure. Singh [4] proposed that there is one female body shape (full buttocks and a narrow waist) that men universally find attractive; and this is defined by an ideal female waist to hip ratio (WHR) of 0.7. The waist to hip ratio is defined as the ratio of the circumference of the waist at its narrowest point to the circumference of the thighs at the level of maximal lateral projection (level of the trochanteric depression). (See Chap. 7 for more details.) A successful gluteal augmentation procedure is therefore defined as one in which the surgeon successfully brings the woman as close to the ideal WHR of 0.7 as possible [5].

Since the advent of body contouring surgery, many different ways of evaluating the gluteal region have been proposed to help surgeons achieved optimal results in contouring of and around the buttocks. In 2004, Cuenca-Guerra et al. [6] first reported their analysis of more than 24,000 images of the gluteal area taken from various media sources. He defined four recognizable characteristics of an aesthetically pleasing gluteal region (Fig. 6.3):

1. Two well-defined dimples on each side of the medial sacral crest that correspond to the posterior-superior iliac spines (PSIS)
2. A V-shaped crease (or sacral triangle) that arises from the proximal end of the gluteal crease

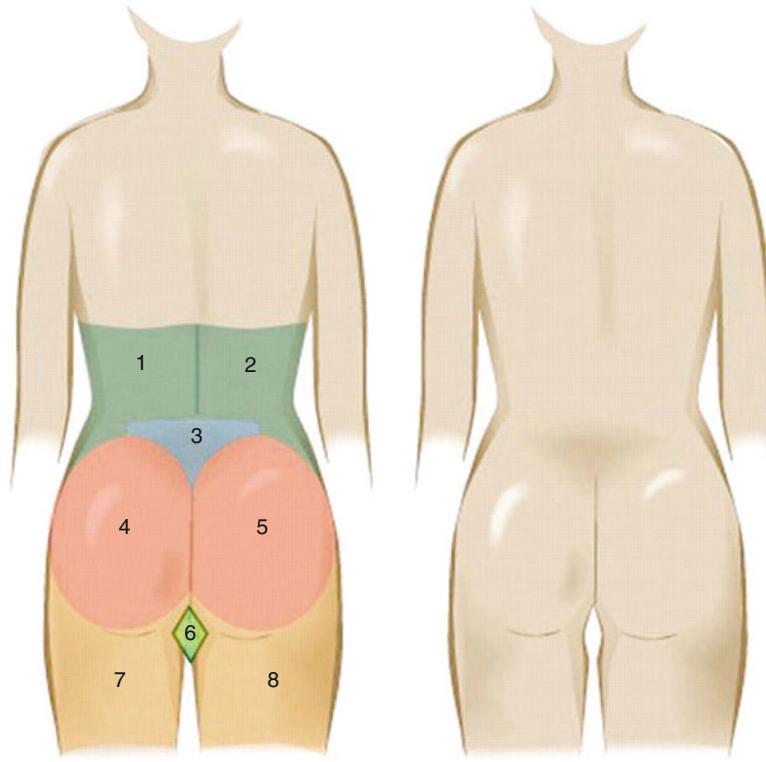


Fig. 6.4 The 8 gluteal aesthetic units of Centeno include *1*, *2* two symmetrical flank units, *3* one sacral triangle unit, *4*, *5* two symmetrical gluteal units, *7*, *8* two symmetrical thigh units, and *6* one "infragluteal diamond" unit

3. Short infragluteal folds that do not extend beyond the medial two-thirds of the posterior thigh
4. Two mild lateral depressions that correspond to the greater trochanter of the femur

Centeno in 2006 [7] described one of the other primary methods for evaluation of the buttocks to help plan body contouring procedures. From the posterior-anterior view of the patient, he defined eight gluteal aesthetic units that help form an aesthetic bottom. By his estimation, the gluteal region consists of two symmetrical "flank" units, a "sacral triangle" unit, two symmetrical gluteal units, two symmetrical thigh units, and one "infragluteal diamond" unit (Fig. 6.4). Accentuation of these units with liposculpture, buttock implants, or hip implants would aid in producing a more aesthetically pleasing contour to the buttock region. When considering procedures that involve incisions, Centeno recommended careful incision placement to respect the junctions of these aesthetic units.

Mendietta in 2006 [8] described a gluteal evaluation system where he analyzed the underlying bony framework of the buttocks, the skin, and the subcutaneous fat distribution, in addition to the musculature of the region. First, he recommended an evaluation of the pelvic frame. Next, the gluteus muscle is evaluated in its height and width. He divided the buttock into four quadrants: upper inner, lower inner, upper outer, and lower outer. Determination of volume addition should be based on analysis of these four quadrants of the buttock. Any additional procedures that need to be performed (e.g., buttock lift or liposculpture) can then be determined by the analysis of these defined criteria.

History of the Procedure

Many surgeons on many continents have added to the knowledge base and growing amount of literature on gluteal augmentation procedures. Gluteal augmentation surgery began in 1965 when Bartels first used a mammary prosthesis (Cronin prosthesis) in the gluteal region to produce a more round and supple bottom side [9]. Subsequently, Cocke in 1973 [10], Douglas in

1975 [11], and Buchuk in 1980 [12] described their early experiences with aesthetic gluteal augmentation. Robles in 1984 [13] reported on his placement of a submuscular gluteal implant with an incision in the medial sacral line. In 1991, Gonzalez Ulloa [14] described his 10-year experience with buttock augmentation. Recently, Vergara [15] presented his 15-year experience with the procedure.

Over the past three decades of advancements in gluteal augmentation, surgeons have proposed various methods of performing the augmentation to achieve the most aesthetic result with minimal complications. Gonzalez Ulloa [16] is regarded by most as one of the great pioneers and grandfathers of buttock augmentation, having begun his work late in the 1970s and presenting his work in Mexico City in 1977. A large portion of his early procedures were performed on patients who had suffered severe damage and/or deformation of the gluteal region due to silicone, collagen, or guaiacol injections. In his early reports of the procedure, he recommended placement of the implant above the gluteus maximus muscle with an incision in the subgluteal sulcus. This subcutaneous plane has largely been abandoned by many surgeons as it can produce an unnatural look and has a large risk of implant migration. Robles in 1984 [13] reported on placement of implants in the submuscular plane with an incision along the medial sacral line. In 1995, the primary author evaluated Robles' work and felt that the potential for injury to the sciatic nerve was too great and began working to place gluteal implants in a more superficial submuscular space, which would later be termed the "intermuscular" space. His initial work on 22 gluteal augmentations performed in the intermuscular space was published in early 1997 as a "modification of buttock augmentation" [17]. The intermuscular space was defined as the potential space that was visualized between the gluteus maximus above and the medius and minimus below during surgical dissection. An implant could easily be placed into this position, thereby minimizing trauma to the gluteus maximus muscle and avoiding injury to deeper muscles and neurovascular structures. Vergara and Marcos [15] later described their use of the "intramuscular" plane for gluteal implant placement based on cadaver dissections which showed an intramuscular anatomic space available for augmentation, larger in size than the submuscular space previously noted by Robles [13]. This paper validated the placement of a silicone prosthesis between the fasciculi of the gluteus maximus muscle and avoided the deeper plane which would put the patient at greater risk of sciatic nerve injury. However, this description differed from that of the primary author in that Vergara attempted placement of the implant within the gluteus maximus muscle rather than placing the implant fully under the maximus muscle. Vergara, along with other authors that use the intramuscular plane, emphasizes the need for maintaining a superior muscle flap covering the implant that is at least 3 cm thick [17–19]. Later in 1997 Peren et al. [20] described their work with augmentations done in the subfascial plane. This was then revisited in 2004 by de la Pena [21]. The limitation of the subfascial plane is that large volume implants with significant projection increase cannot be used due to the tightness of the pocket. Additionally, because of its more superficial position, there is a greater chance of implant palpability. Most recently, Gonzalez [22] introduced the XYZ method for gluteal augmentation. Gonzalez uses the same intramuscular plane as described by Vergara but introduces a means of orienting the gluteal implants to maximize symmetry and aesthetic results. He defines a point X as representing the center of the gluteus maximus muscular mass at the site of access to the submuscular plane. He performs dissection cephalically up to a point Y which is just past the lower iliac spine. Then along a vector named line G, he dissects caudally down to a point Z which is at the level of the trochanter and still beneath the gluteus muscle. Gonzalez asserts that his technique is important in gluteal augmentation as natural and reliable pelvic landmarks are used for dissection as preoperative cutaneous markings often provided a distorted view of the anatomy when the patient is in the prone position for surgery, helping to produce more reliably aesthetic outcomes [22].

In considering incision placement for the procedure, early surgeons worked through bilateral infragluteal sulcus incisions [9–12, 14]. This was then followed by bilateral coccygeal incisions as used by Gonzalez Ulloa [9]. Later surgeons felt that less incisions could lead to less postoperative morbidity. For this reason, incision placement turned to use of a single 5–7 cm incision hidden in the intergluteal cleft [13–15, 17, 18]. Mendietta in 2005 [23] presented his approach to gluteal augmentation, suggesting two paramedian incisions in order to decrease the risk of wound dehiscence. By placing two incisions, there was less trauma to the incision and tension was minimized. Most recently, in 2007, Badin and Vieira [24] discussed their experience with a small intergluteal crease incision with pocket dissection using endoscopic technology aimed at minimizing the risks of sciatic nerve injury and maximizing aesthetic gain.

Implants Used (Table 6.1)

In 2006, De la Pena [25] described the history of gluteal augmentation and briefly discusses the differences in implants used for buttock augmentation between the United States and countries outside it. He notes that there are two primary types of buttock implants available commercially: semisolid elastomer implants and cohesive gel implants. In 2012, Bortoluzzi Daniel [19] sought to evaluate the durability of gluteal prostheses and noted that cohesive gel implants, as used in his native Brazil, had a high failure rate and risk of rupture when compared to the semisolid elastomer-type implants used by surgeons in the United States. Cohesive gel implants have a shortened useful lifespan due to the fact that creases can sometimes fold in the implant itself combined with the significant force of compression produced by sitting on the implants. Studies performed on breast augmentation patients suggest that cohesive gel implants may need replacement in 20–40 % of patients at 8–10 years. Based on the research of Bortoluzzi Daniel, this half lift is considerably shorter for gluteal implants because of the constant tension that they are subjected to. Although the search for the ideal implant continues, the semisolid elastomer implant and cohesive gel implant have underscored the major developments in buttock augmentation surgery.

Table 6.1 Types of buttock implants used

Implant type	Advantages	Disadvantages
Semisolid elastomer	Does not rupture	Firmer buttocks
Cohesive gel	Soft and natural feel	Possibility of rupture
	Less palpable	Not available in the United States

The large majority of the US companies are making implants that are semisolid and rigid. Implantation of these types of implants does have the advantage of not rupturing; however, it can lead to a more firm buttock region. This is in contrast to the implants frequently used in Latin American countries that are often made of a cohesive gel within a thick and resilient silicone shell (Fig. 6.5). These implants are softer and have a more natural feel according to physicians that use them. The major downside of these implants, however, is the risk of rupture. In our own practice, it is our feeling that implants made by AART (Aesthetic and Reconstructive Technologies, Inc., Reno, NV) not only provide rigidity needed to provide a solid augmentation but are pliable enough to make them natural in their look and feel when implanted.

Fig. 6.5 Cohesive gel implants used for gluteal augmentation

Relevant Anatomy

In Centeno's [7] work, there are four superficial landmarks that should be identified and potentially accentuated in buttock augmentation/contouring. These four areas are the sacral dimples (overlying the PSIS), the sacral triangle (formed by the two PSIS and the coccyx inferiorly), the lateral depression correlating to the greater trochanters of the femur, and the short infragluteal fold. When performing buttock augmentation, one should be careful not to obliterate these landmarks and may even consider the adjunctive use of liposculpture to further enhance these landmarks in addition to performing the buttock augmentation.

The buttock region has investing fascia that helps prevent gluteal ptosis and provide structural support to the gluteal area. The superficial fascia as described by Lockwood [6] fuses with the deep gluteal fascia at the level of the infragluteal fold to create a tight adherence which needs to be respected in augmentation and liposculpture procedures [26]. A violation of this tight adherence can lead to significant gluteal ptosis which is difficult to reconstruct if lost. In addition to helping to create the infragluteal fold, the superficial fascial system along with the deep investing fascia of the gluteus muscle is key to providing a sound closure at the end of the procedure and should be employed in a layered closure of the midline buttock incision.

The muscles that comprise the buttock region are several, but the primary volume is formed by the three gluteus muscles (Fig. 6.6). The gluteus maximus muscle originates on the fascia of the gluteus medius muscle, the external ilium, the fascia of the erector spinae, the dorsum of the lower sacrum, the lateral coccyx, and the sacrotuberous ligament [27]. It inserts on the iliotibial tract and proximal femur. The muscle is a powerful extensor of the flexed femur and provides lateral stabilization of the hip. The gluteus medius originates on the external ilium and inserts on the lateral greater trochanters. It acts to abduct the hip and thigh and helps to stabilize the pelvis during standing and walking. During dissection, it can be differentiated from

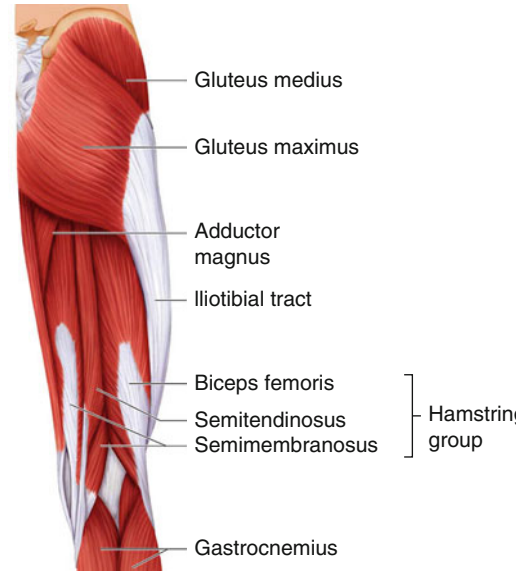


Fig. 6.6 Gluteal muscles (maximus, medius) depicted and their relationship to key muscular structures in the lateral hip/thigh and lower extremity. Gluteus minimus is not depicted

the gluteus maximus because of its vertically oriented fibers. The gluteus minimus originates on the external surface of the ilium and inserts on the anterior-lateral greater trochanter. This muscle abducts the femur and also serves as a pelvic stabilizer.

Blood supply in the gluteal region is rich and reliable. The musculocutaneous structures in the gluteal region are largely supplied by the perforating branches of the superior and inferior gluteal arteries, which are terminal branches of the internal iliac artery [28]. Accessory blood supply comes from the deep circumflex iliac, lumbar, lateral sacral, obturator, and internal pudendal arteries. The superior and inferior gluteal veins provide venous drainage of the region. When considering dissection of the gluteus muscle, one must be careful to avoid sharp dissection very close to the sacrum and sacrotuberous ligament as injury to the gluteal arteries can occur [22].

There is a rich complex of nerves that innervate the muscles of the buttock region and provide sensation to the overlying skin. They largely originate from the lumbosacral plexus. The gluteus maximus is innervated by the inferior gluteal nerve. This nerve comes from the pelvis to the

gluteal area, crossing the great sciatic foramen posteriorly and in a way medial to the sciatic nerve. It divides into three collateral branches: the gluteus (motor nerve of the gluteus maximus), the perineal, and the femoral (sensory nerve). The branches of the inferior gluteal nerve are like a crow's foot when dividing into its branches. These branches then course between the gluteus muscle and its anterior fascia, with the largest segments (fillets) of this nerve being close to the sacrum and sacrotuberous ligament. It is for this reason that undermining inside the gluteus muscle must never be performed to close to the sacrum, the sacrotuberous ligament, or the sciatic tuberosity [22].

The gluteus medius and minimus are innervated by the superior gluteal nerve. Sensation to the gluteal region and lateral trunk comes from several sources: the dorsal rami of the sacral nerve roots 3 and 4, the cutaneous branches of the iliohypogastric nerve, and the superior cluneal nerves that originate from the L1, L2, and L3 roots. The iliohypogastric and ilioinguinal nerves, branches of the L1 nerve root, supply the skin overlying the lateral gluteal region and can be injured with aggressive lipocontouring of the lateral buttock region. Lastly, the sciatic nerve is the largest nerve of the body and originates from the nerve roots of L4 through S3 (Fig. 6.7). It exits the gluteal region through the greater sciatic foramen below the piriformis muscle and above the superior gemellus muscle to enter the posterior compartment of the thigh. Compression or injury of the sciatic nerve may cause loss of function of the posterior thigh compartment muscles and all muscles of the leg and foot and loss of sensation in the lateral leg and foot as well as the sole and dorsum of the foot [29].

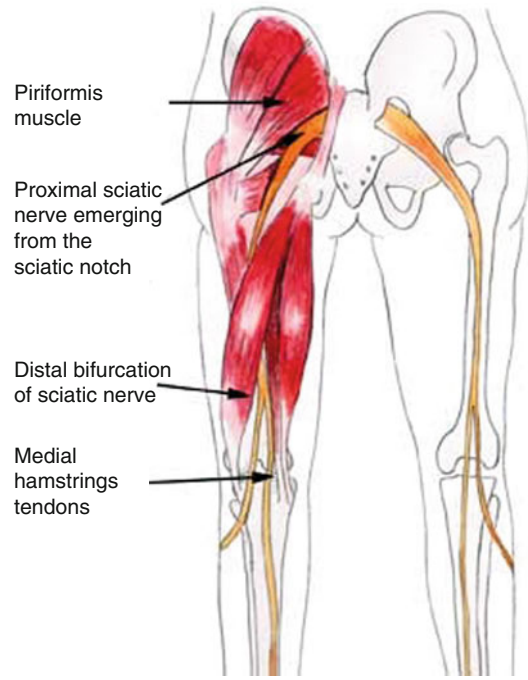


Fig. 6.7 Course of the sciatic nerve with its exit at the inferior pole of the gluteus muscle. Because of its course, this nerve is at risk for injury during submuscular placement of a gluteal prosthesis either by traction injury or by direct compression by the implant

Indications

Gluteal augmentation with implants is indicated in patients who suffer from insufficiency of the gluteal region. These patients are typically young and have good muscle and skin tone but lack volume or definition to the gluteal region. Gluteal implants are also indicated in patients who suffer from ptosis of the gluteal region and wish to have a perkier appearance to the buttocks. Another set of patients that benefit from gluteal augmentation with implants are those who have a congenital gluteal deformity or acquired asymmetry (due to trauma, postoperatively, or post-oncologic resection).

Contraindications/Limitations

Relative contraindications to the procedure are few and typically deal with tissue irregularities in the area to be augmented. One such limitation is a depressed scar in the buttock area which may require adjunctive procedures to cause a release of the scar. Patients who have suffered from radiation to the area have a relative contraindication to surgery as their tissues may be indurated and healing may not be optimal postoperatively. Another patient who may have a

relative or absolute contraindication to implant surgery is the patient who presents with deficiency of the lateral and inferior portions of the buttocks. When performing buttock augmentation with implants, the inferior pole remains largely unchanged as too caudal a dissection can put the sciatic nerve at risk of injury. For that reason patients who have a significant deficiency at the lower pole should be counseled to consider fat grafting and implant augmentation. Similarly, deficits in the lateral aspect of the butt are largely unchanged with implant augmentation. Although there will be a slight improvement in the lateral curvature of the buttocks, significant deficits may best be treated with fat grafting or possibly a hip implant. Patients who suffer from autoimmune diseases may be at increased risk postoperatively and should be counseled appropriately prior to pursuing any implant surgery. A patient who presents with unrealistic expectations or suffers from major psychological illness is not an appropriate candidate for buttock augmentation surgery.

Consultation/Implant Selection

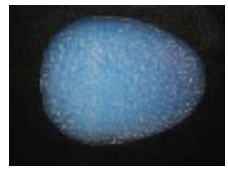
A thorough history and physical are paramount to preventing complications at the time of buttock augmentation. Questions are posed regarding the patient's reasonable attempts to build the muscle with conventional means. During the consultation, patient's expectations are managed and assessment of the patient's mental state is undertaken. It is made clear to the patient the expected augmentation that can be achieved, and limitations of the procedure are also explained.

After completion of the history portion of the consultation, an evaluation of the patient's buttocks is made. Any asymmetries or defects are pointed out to the patient. The patient's muscles are then evaluated. The skin and fat content are similarly assessed at this time as a patient with minimal adipose and thin skin is more at risk for implant palpability. Measurements of the patient's buttocks in the transverse axis are then taken in the midportion of the gluteal region beginning 1 cm lateral to the intergluteal crease and ending at the lateral palpable edge of the buttock muscle. This measurement allows the physician to choose an implant that will adequately fill out the gluteal region and is analogous to determining the base width in breast augmentation. Measurement of the vertical height of the buttock is taken from its most cranial portion to its most caudal portion 2 cm short of the infragluteal crease.

Available Implants (Tables 6.1, 6.2, 6.3, and 6.4)

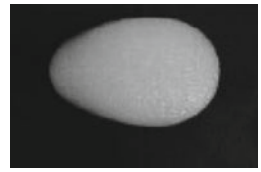
The authors' preference is the style 3, round implant.

Table 6.2 Style 1 buttock implants (Aesthetic and Reconstructive Technologies, Inc., Reno, NV)



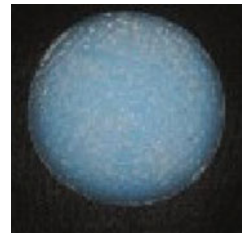
Size	Catalog #	Width	Length	Projection	Volume (cc)
1	501–101	10.4	15.0	2.5	207
4	501–102	11.0	15.6	3.1	250
3	501–103	13.5	18.0	4.6	545
4	501–104	11.1	16.2	3.2	303
5	501–105	11.5	16.6	3.6	328
6	501–106	12.9	18.0	4.2	435

Table 6.3 Style 2 buttock implants (Aesthetic and Reconstructive Technologies, Inc., Reno, NV)



Size	Catalog #	Width	Length	Projection	Volume (cc)
1	501–201	12.4	14.5	2.5	194
2	501–202	12.7	15.4	2.9	234
3	501–203	12.8	16.5	3.3	292
4	501–204	13.4	18.0	3.8	375
5	501–205	14.6	19.3	4.8	575
6	501–206	12.5	16.4	4.6	430

Table 6.4 Style 3 buttock implants (Aesthetic and Reconstructive Technologies, Inc., Reno, NV)



Size	Catalog #	Diameter	Projection	Volume (cc)
0	501–300	10.5	2.5	117
1	501–301	12.5	2.8	189
2	501–302	13.4	3.6	276
3	501–303	14.5	3.8	379
4	501–304	13.4	4.9	434
5	501–305	13.5	3.7	301
6	501–306	15.0	5.5	713
6	501–307	12.5	4.0	296
8	501–308	12.0	3.5	215
9	501–309	15.0	4.5	485
10	501–310	15.0	5.0	550

Preoperative Planning and Marking

On the day of the surgery, the patient is met in the preoperative holding area. It is here that the patient's consent is verified and again risks, benefits, and alternatives are reviewed with the patient. With the patient in the erect position, the proposed site of incision is marked, measuring approximately 5–7 cm. The site of incision should be in the intergluteal cleft, starting at the apex of the cleft and proceeding caudally. This line of incision must be marked in the upright position preoperatively as the intergluteal sulcus loses its definition when the patient is in the prone position during surgery. The area around the anus should be respected, and incisions should not exceed a 5 cm boundary around the anus to avoid injury to the sphincter complex. Once the site of the incision is marked, the site of the proposed implant is marked taking into account the patient's anatomy and existing deficit along with the desires of the patient (Fig. 6.8).

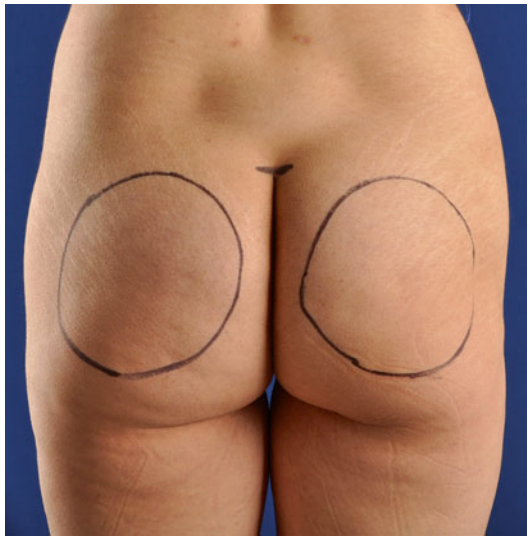


Fig. 6.8 Preoperative markings. Note the superior most *horizontal marking* indicating the beginning of the natural intergluteal fold. Just below this line is the starting point for the intergluteal fold incision. The site of the proposed implants is marked preoperatively, taking care to ensure that they are evenly placed away from midline (ruler used to ensure symmetric placement). The outline of the implant helps to control dissection intraoperatively

The superior excursion of the buttock is marked with manual manipulation of the buttock in the cephalic direction if liposuction of the hips is to be done. The sacral triangle is marked for reference if liposuction of the sacrum/flanks is to be performed at the same time.

Operative Technique

The patient is brought to the operative suite. Anesthesia is administered. The patient is then placed in the prone position. The buttocks and perianal region are prepped and draped in sterile fashion. The previously marked incision site in the intergluteal cleft is incised with a #15 blade scalpel, taking care not to violate the 5-cm safe zone proximal to the anus (Fig. 6.9). Dissection is carried through the subcutaneous tissues using electrocautery, using hooks in the skin to provide adequate visualization (Figs. 6.10 and 6.11). The incision is carried down to the level of the presacral fascia, making sure to maintain the presacral

Fig. 6.9 Incision in the intergluteal fold

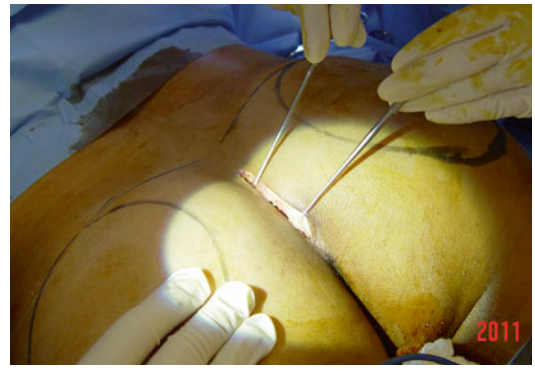


Fig. 6.10 Hooks placed in the skin to aid in dissection of the subcutaneous plane, taking care to preserve the presacral fascia which will be used at closure

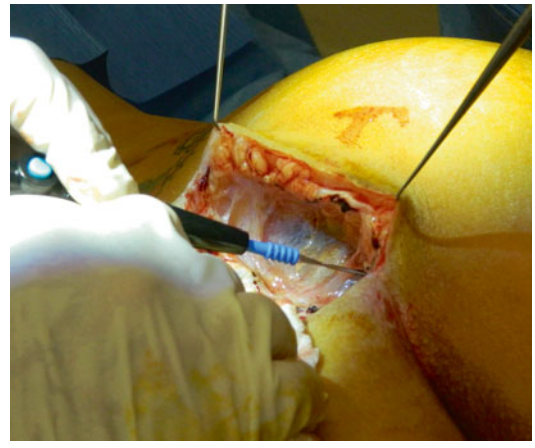


Fig. 6.11 Dissection through the subcutaneous tissue using electrocautery

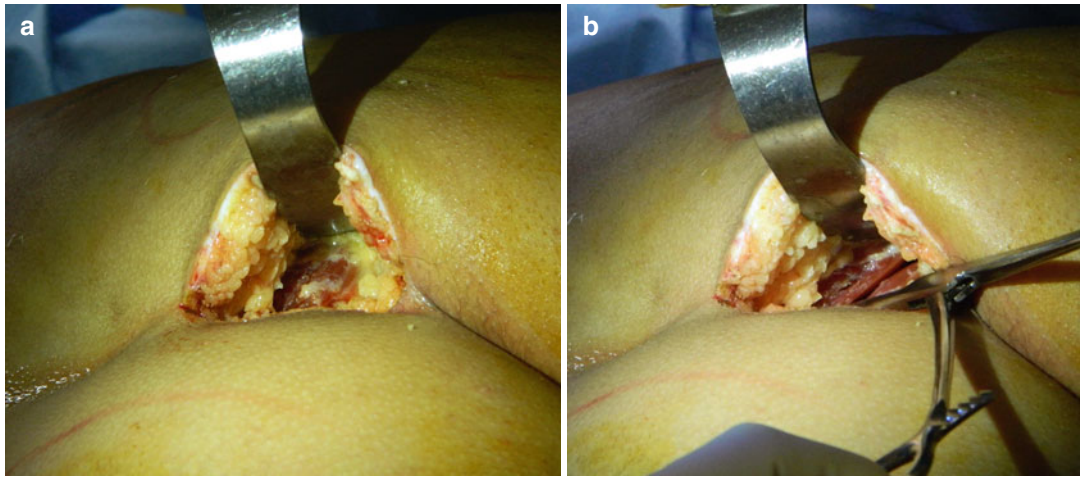


Fig. 6.12 (**a**) Subcutaneous tissue has been dissected away from underlying muscle, exposing the gluteus muscle. (**b**) Gluteus maximus muscle is split in its midportion in line with its fibers using a Kelly clamp

fascia intact as the closure will utilize this fascia as an anchor to recreate the intergluteal sulcus. Dissection is carried laterally to the gluteal fascia (Fig. 6.12). Dissection is carried laterally for approximately 3–4 cm to better expose the gluteal fascia. At a point found to be in the midsection of the gluteus maximus muscle, the gluteus is split in line with its fibers using a large Kelly clamp to achieve a plane below the gluteus maximus muscle (Fig. 6.12). The opening in the gluteus maximus muscle is then extended using electrocautery to create a 6–7 cm defect in the muscle. A spatula dissector and hockey stick dissector, along with finger dissection, are used to further develop this plane, in line with the proposed site of implant placement (Figs. 6.13 and 6.14). The pocket is created in such a way that the gluteus maximus adequately covers the position of the implant in the medial, lateral, and superficial levels. The gluteus medius and minimus then create the floor of the implant pocket (Fig. 6.15). When considering dissection of a buttock augmentation procedure, the medial extent of dissection should respect the sacral triangle. Care is also taken to minimize dissection in the lower third of the buttock which is the support zone of the buttock and supports the weight of the body when sitting. A key point for the novice surgeon at this stage is that one should err on the side of a tight pocket to minimize the risk of over-dissection and increased potential for

Fig. 6.13 Initial dissection of the intermuscular plane using blunt finger dissection

implant migration that comes with too loose a pocket for the implant. The pocket is then packed with peroxide-soaked sponges, and attention is turned to the contralateral side for similar dissection (Fig. 6.16). Once all dissection has been completed, implant pockets are evaluated for hemostasis. Hemostasis is achieved as necessary with electrocautery. Next, the pocket is irrigated with an antibiotic solution containing Betadine, normal saline, 80 mg gentamicin, and 1 g of Ancef (if the patient is not penicillin allergic). The irrigant is then suctioned out. Ten milliliters of

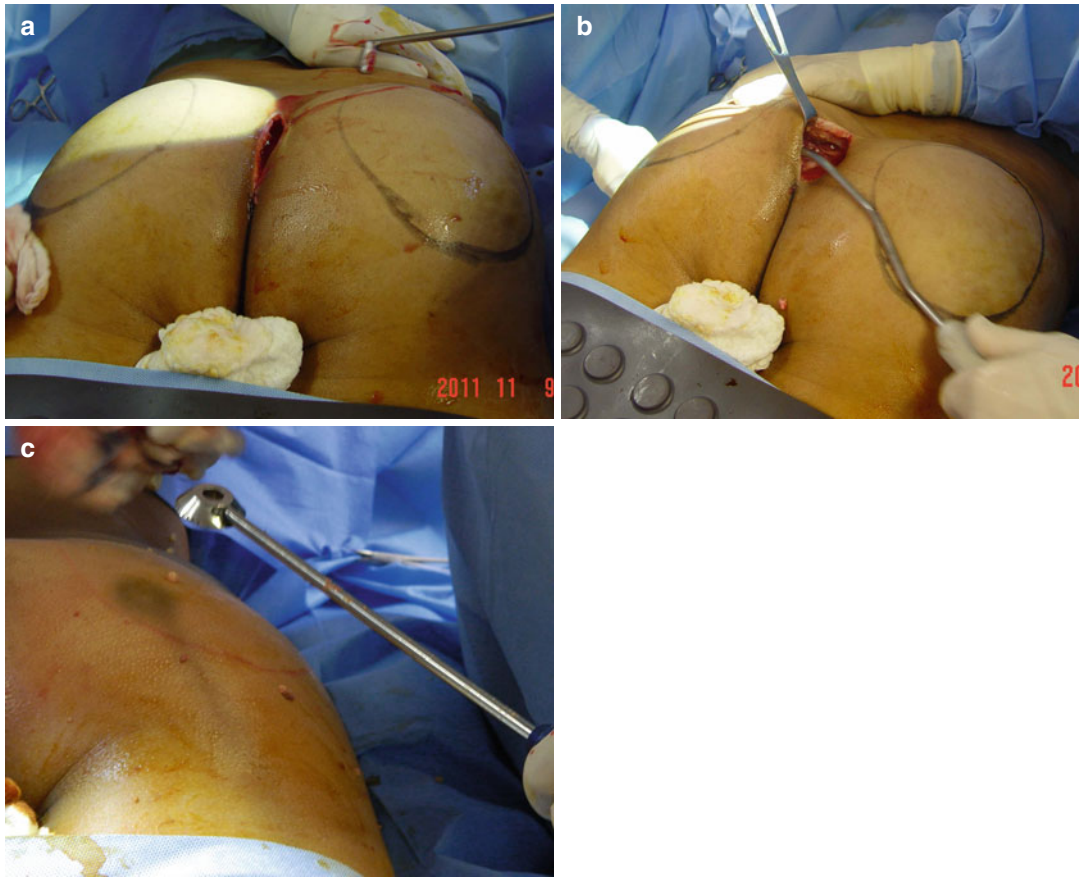


Fig. 6.14 (**a**) Dissection of the intermuscular plane using a hockey stick dissector. (**b**) Dissection of the pocket using a spatula dissector. (**c**) A serrated dissector may be used if there are resistant strands of gluteus muscle that need to be freed to accommodate the implant

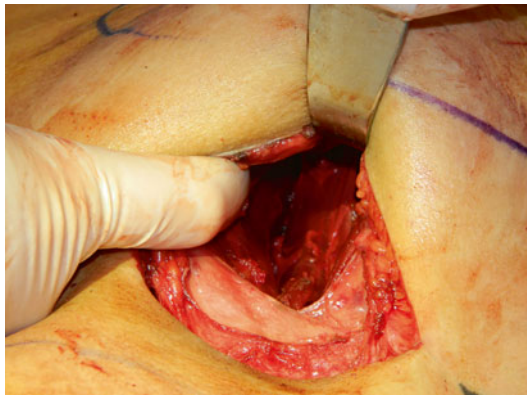


Fig. 6.15 Dissection of the intergluteal plane has been completed. The subcutaneous tissues and gluteus maximus are elevated demonstrating the underlying gluteus medius muscle with transversely directed fibers

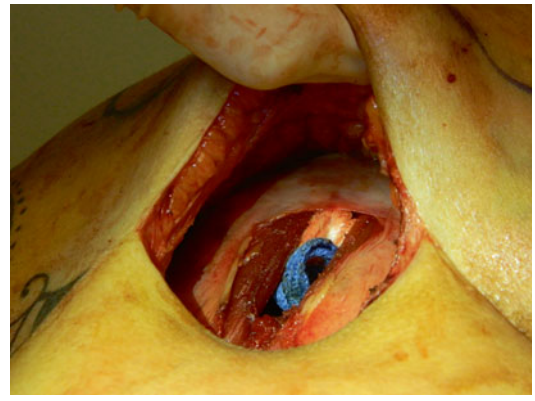


Fig. 6.16 Lap sponges in position in the intermuscular plane

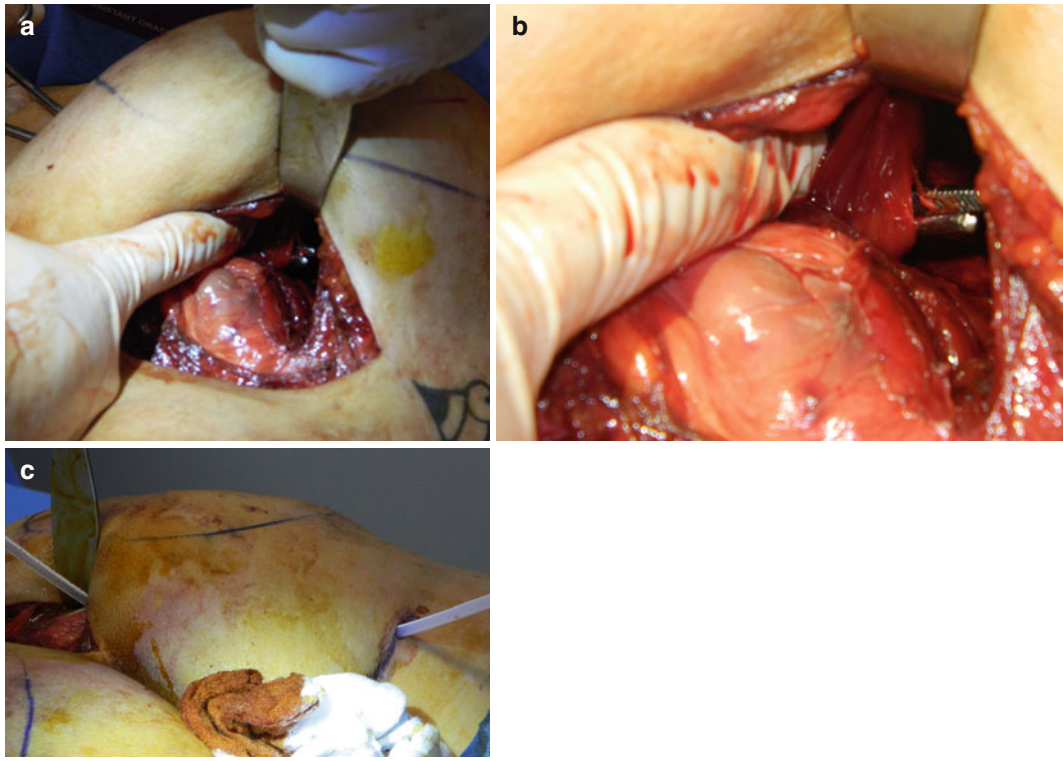


Fig. 6.17 (**a**) Drain placement via a stab incision in the infragluteal fold. (**b**) Close-up view of Kelly clamp being extended into the intermuscular pocket with the tip of the Kelly spread to accept the drain. (**c**) Drain in position with exit in the infragluteal fold

0.5 % Marcaine is instilled into the pocket to allow for postoperative pain control. Drains are placed via stab incisions in the infragluteal fold using a #15 blade scalpel. Jackson-Pratt drains are then introduced into the pocket and laid into the base of the pocket and secured with 3-0 Nylon suture (Fig. 6.17). The appropriately selected gluteal implant is folded in half (like a taco) and introduced through the incision in the gluteus maximus (Fig. 6.18). The implant is placed in the contralateral side in the similar fashion. Symmetry is then assessed. Once this is deemed to be satisfactory, closure is begun. A 0-Prolene suture (or permanent suture of surgeon's preference) is then used in interrupted fashion to close the gluteus muscle and fascia over the implant (Fig. 6.19). Once the implant has been fully covered, the intergluteal incision is closed in layers. First, 2-0 Vicryl suture is used to reapproximate the deep subcutaneous tissues and deep dermis to the presacral fascia to recreate the gluteal cleft. 3-0

Fig. 6.18 *Left side* augmented with surgeon now returning to the *right side* for removal of packs and placement of right gluteal implant

Vicryl is used as necessary to fully approximate the dermis. 3-0 silk sutures in interrupted fashion are used to close the skin. The patient's wound is dressed with Neosporin and absorbent pads. The patient is then placed in a compression garment. Anesthesia is discontinued and the patient is taken to the postanesthesia care unit (PACU).

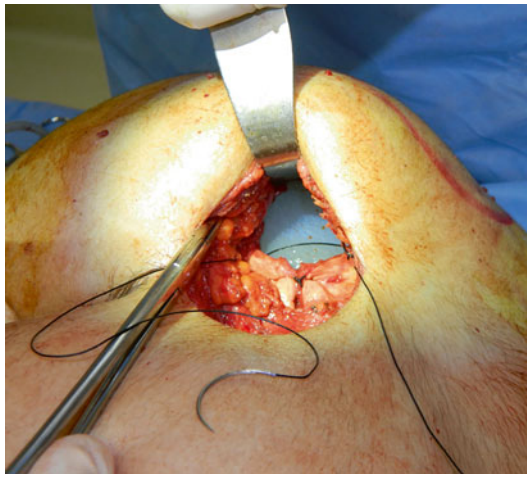


Fig. 6.19 Closure of gluteus maximus muscle over the underlying implant using permanent suture

Table 6.5 Potential complications of buttock augmentation

Potential complications of buttock augmentation surgery
Infection
Seroma
Hematoma
Asymmetry
Implant visibility
Implant bottoming out/double-bubble deformity
Implant rupture
Hypertrophic scarring
Hyperpigmentation of the scar
Capsular contracture
Wound dehiscence
Nerve injury (permanent or temporary, motor or sensory)
Pulmonary embolism
Compartment syndrome

Postoperative Care/Instructions

Postoperatively the patient may begin ambulating starting on the evening of the procedure. They may shower POD 2, making sure to keep the dressings clean. The buttock region is dried and antibiotic ointment is applied in a thin layer. Patients are then allowed to begin light activity at week 2 and full unrestricted activity at weeks 4–6. Patients are asked to wear an elastic compression garment for 4 weeks postoperatively to prevent dead space, thereby helping to reduce the risk of seroma formation. The legs are to be elevated as much as possible to allow for better lymphatic/venous drainage. Narcotic analgesics are prescribed along with muscle relaxants (diazepam 5 mg every 8 h as needed for spasm) to assist with postoperative pain. Patients are placed on broad-spectrum antibiotics for 7 days. The authors' preference is to use ciprofloxacin 500 mg BID for its broad coverage, both gram positive and gram negative. For 2 weeks postoperatively, the patient is asked to sleep on their abdomen or side and avoid direct pressure to the buttocks. After 2 weeks, the patient is cleared to sleep on their buttocks and sit on their new bottom side with the intention of slowly stretching the newly forming scar capsule. In the early postoperative period, patients may sit on their bottom side but favoring a "bird on a perch" position with the majority of bodily weight being focused on the posterior thigh region rather than directly on the midportion of the buttocks.

Complications

In performing buttock augmentation, there is a host of complications that can arise (Table 6.5).

Infection

Infection, either superficial or deep, is a possibility in hip/lateral thigh augmentation surgery. There is a reported infection rate of between 1.4 and 5 % in gluteal augmentation surgery, including both superficial and deep infections [15, 30, 31]. The most likely culprits would be *Staphylococcus aureus* and *Staphylococcus epidermidis*, relatively common skin flora. However, gram-negative infections are also possible secondary to the close proximity to the anal canal. Prior to making incision, standard practice should be the administration of 2 g of Ancef IV (or 300 mg IV clindamycin in a penicillin- or cephalosporin-allergic patient). During the procedure, irrigation of the pocket with a standard antibiotic solution containing normal saline, Betadine, Ancef, and gentamicin should be performed. During surgery,

a Betadine-soaked gauze is secured over the anus to prevent contamination. Postoperatively, a 7–10-day regimen of oral antibiotics covering normal skin flora along with gram-negative organisms should be administered. The authors' standard practice is administration of ciprofloxacin 500 mg orally twice daily for 7 days postoperatively. If a deep infection occurs, the standard of practice is removal of the implant, closure, and possible reimplantation in 3–6 months. There are reports in other forms of implant surgery (breast surgery) that conservative management and implant salvage are possible. This should be left to the discretion of the surgeon and performed with careful counseling of the patient. There are reports of late postoperative gluteal infections after augmentation gluteoplasty, but these are quite rare and typically relate to some trauma to the area [32–34]. These delayed infections are typically managed with drainage of the abscess, implant removal, and antibiotics.

Seroma

Seromas are statistically the most common complication occurring in implant surgeries. They typically present as new onset pain, swelling, or asymmetry. The treatment of choice remains percutaneous aspiration. This complication is best prevented with patient compliance with compression garments for 1 month and proper implant placement at the time of surgery, thereby minimizing dead space. In larger studies, such as those by Vergara and Gonzalez Ulloa, the seroma rate for intramuscular augmentations is reported to be between 4 and 10 % [14, 15, 20, 30]. Other large volume studies such as those by Senderoff [30], evaluating 200 consecutive augmentation cases, report seroma rates as high as 28 %. Seromas are best prevented with drain use in the implant pocket. The authors' standard practice is to leave Jackson-Pratt drains in place until drainage is less than 30 mL/24 h period for 48 consecutive hours.

Occasionally, patients will present with recurrent seromas that are recalcitrant to drainage. If this is the case, a discussion must be had with the patient regarding possible implant removal. Some patients, however, wish to do everything they can to maintain their implant. In this case, the patient does run the risk of having tissue thinning of the buttock due to the constant pressure of the underlying fluid and implant. In one such case, a 26-year-old female underwent buttock augmentation with style 3, size 7 implants and suffered from persistent seromas for 1.5 months that were aspirated in sterile fashion using an 18-gauge needle. After 1.5–2 months, she was noted to have skin thinning in the lower pole of the buttock (dependent) and presented with an exposed implant on the left side (Fig. 6.20). She was taken to the operating room for implant removal, pocket washout, and closure of the defect in the skin. She is awaiting replacement of the left buttock implant to re-achieve symmetry of the buttocks.

Fig. 6.20 A 26-year-old female underwent buttock augmentation with style 3, size 7 implants and suffered from persistent seromas for 1.5 months that were aspirated in sterile fashion using an 18-gauge needle. After 1.5–2 months, she was noted to have skin thinning in the lower pole of the buttock (dependent) and presented with an exposed implant on the *left side*. Note opening in caudal portion of left buttock with exposed implant

Hematoma

Although a rare occurrence due to the relatively avascular plane of dissection for the hip augmentation procedure, a hematoma is always a possibility in surgical procedures. There is a reported incidence of 2 % in buttock augmentation surgery [30]. Small branches of the lateral circumflex femoral artery, a branch of the profunda femoris, can be injured during the dissection for hip augmentation.

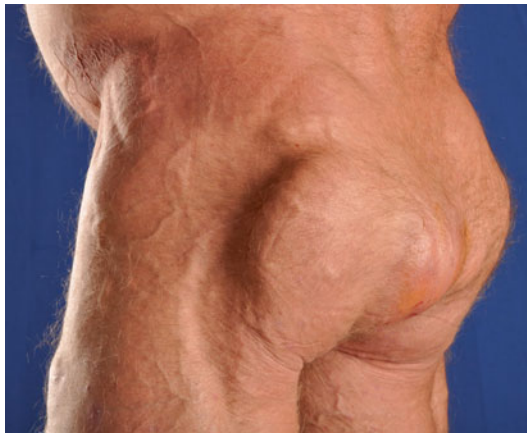


Fig. 6.21 A 46-year-old male, who was HIV positive, suffered a delayed hematoma years after his initial augmentation

In the event of a hematoma, rapid evacuation, pocket irrigation, and reimplantation are the mainstays of therapy. This complication is best prevented by meticulous hemostasis at the time of surgery and good compression of the buttock postoperatively to prevent potential space creation.

In the authors' series, there was one case of a delayed hematoma. A 46-year-old male, who was HIV positive, suffered a delayed hematoma years after his initial augmentation (Fig. 6.21). He had previously undergone buttock augmentation 11 years ago and then noted in the last several months prior to presentation that he had increased volume in the buttocks region that was soft to touch. He was subsequently taken to the operating room (OR) for drainage. Four hundred milliliters of serosanguinous matter was suctioned and likely was the result of a capsular tear (Fig. 6.22). No active bleeding was noted on evaluation of the region.

Asymmetry

This can occur as a product of preexisting variability in the patient's legs or variability in dissection of the pocket bilaterally. This is best minimized by good preoperative photography and noting any asymmetries preoperatively (Fig. 6.23). To avoid creation of asymmetry intraoperatively, it is important to maintain the same pattern of dissection and pocket creation bilaterally. Vergara

Fig. 6.22 Evacuated hematoma in patient with delayed hematoma

[15], in his 15-year experience with intramuscular placement of gluteal implants, reports an incidence of 2.6 % of asymmetry. Mendieta [31] reports an incidence of 5 %.

Implant Visibility/Palpability

Due to the intermuscular placement of the implant, in our practice, this is indeed a rare complication. For surgeons that perform the augmentation in the subfascial plane, there is a greater risk of implant palpability just by virtue of less tissue covering the implant [20, 21, 25]. Mendieta [31] in the first large volume US study on buttock augmentation with implants noted a rate of implant exposure of 2.7 % (2/73). However, those patients that have very thin and atrophic buttocks to begin with may suffer from implant palpability and visibility. Patients should be counseled on this fact preoperatively if there is a feeling that the patient could be at risk. Several authors who espouse the intramuscular approach to gluteal augmentation do warn

Fig. 6.23 Patient who presented for buttock augmentation and had preexisting asymmetry of the buttocks. There is a wider buttock on the *left side* with much more shapely buttock on the *right side*. The patient has a small indentation of the left buttock. The creases inferiorly are also asymmetric with two creases noted in the right gluteal area when compared to the single crease on the left. Cellulite is also evident in the buttocks. All of these existing irregularities should be pointed out to a patient prior to augmentation as there will still be asymmetry postoperatively

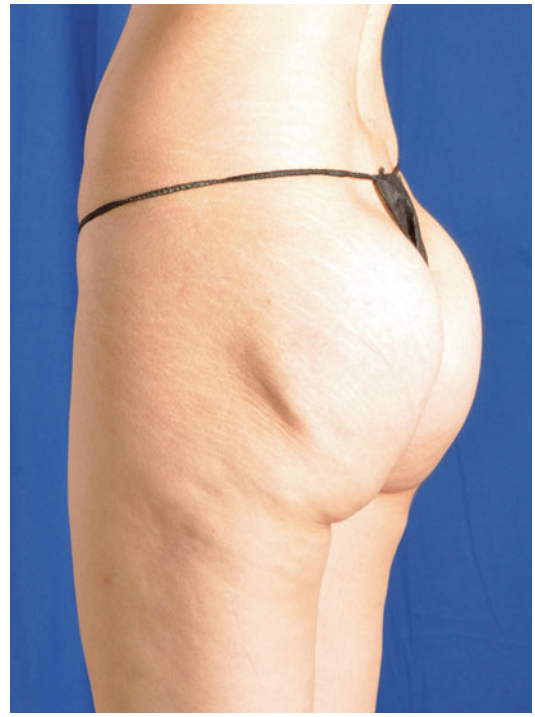


Fig. 6.24 Lateral exposed implant in a patient that was thin and had dissection in the superficial plane laterally causing exposure of the implant. This was corrected at subsequent surgery with placement of the implant below the existing capsule to better hide the implant edge

about the risk of becoming too superficial in the lateral dissection of the implant pocket, which could leave the implant exposed, due to the tapering of the gluteus maximus muscle in the lateral buttock region. For that reason, care must be taken in the dissection of the lateral aspect of the pocket, making sure to drive the dissector into a deeper plane to avoid leaving the implant covered only by subcutaneous tissues in the lateral aspect [15, 22, 23]. It is for this reason that Gonzalez [22] strongly recommends the XYZ approach to intragluteal gluteoplasty, as reliable anatomic points of reference may be used to guide pocket dissection. In the authors' practice, patients did at times present with implants that were palpable in the lateral aspect due to overly superficial dissection in the lateral aspect, leaving the implant not fully covered by muscle laterally (Fig. 6.24). This can be corrected with a reoperation no sooner than 3 months after the initial surgery. At the time of the second surgery, the surgeon will find a capsule formed and will then place the implant below the formed capsule, camouflaging any lateral implant palpability. A partial anterior capsulectomy should also be considered at this time to minimize the risk of a seroma formation postoperatively in the previously created pocket which will now be devoid of implant. Also, patients have presented to the practice with flipped implants (Fig. 6.25). This has been seen in patients that are thin to begin with and have minimal surrounding tissue around the implant and experience a flipping of their implant with movement. An in-office procedure or manual manipulation at home will typically correct this problem. Should this continue to repeat itself, the surgeon may consider a submuscular placement of the implant, but this

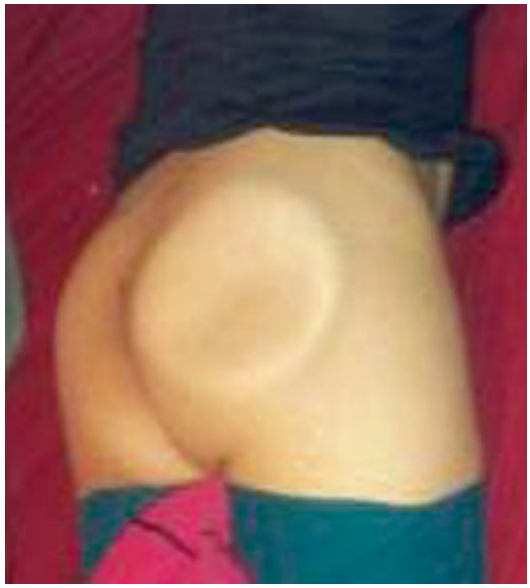


Fig. 6.25 Flipped right implant in a patient who was 120 lb at the time of her buttock augmentation and then lost 20 lb secondary to illness, creating very thin and loose tissues. She was able to easily manipulate the implant into position. She is slated for surgery to place the implant in a deeper submuscular position

increased risk of neurovascular injury must be fully discussed with the patient prior to proceeding down this route.

Implant Bottoming Out/Double-Bubble Deformity

With implants placed in the subcutaneous plane, there is a risk of implant bottoming out. This occurs as there is insufficient support around the implant to maintain its position. The skin and subcutaneous tissues are left to fight gravity and are unable to sustain the implant (Fig. 6.26). In the worst case scenario, the implant can move so far inferiorly as to create a double-bubble deformity, where the edge of the implant is noted as well as the natural crease of the buttock (Fig. 6.27). These complications are best corrected with implant placement in a deeper, intermuscular, intramuscular, or submuscular position.

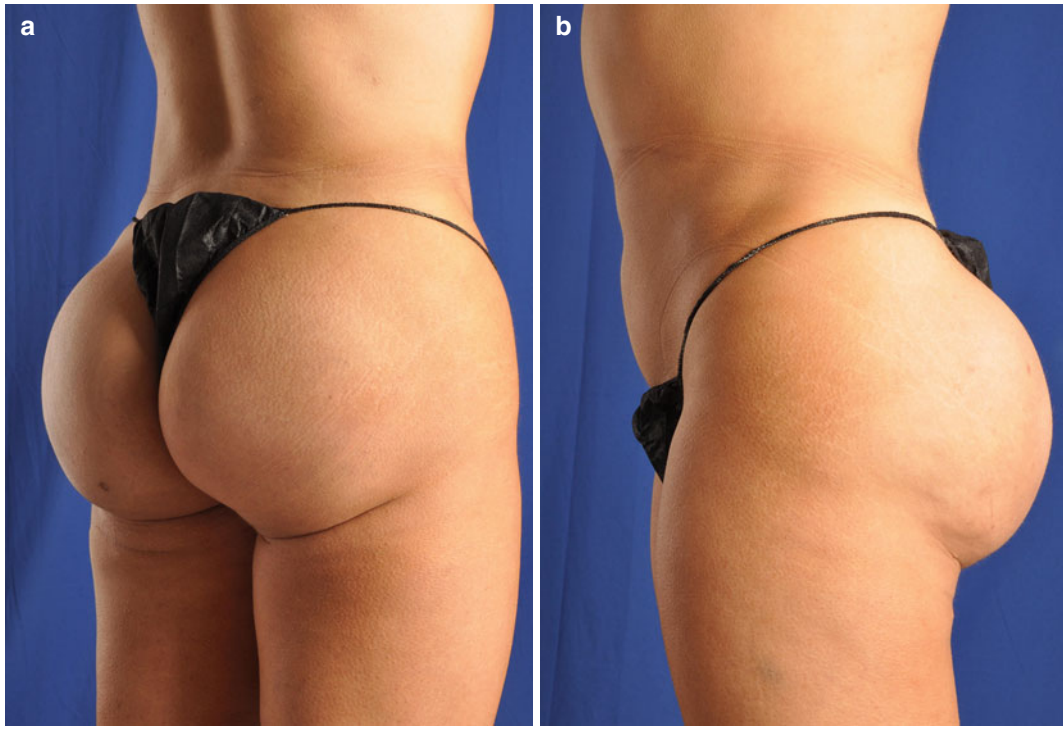


Fig. 6.26 (**a**, **b**) A 33-year-old female had undergone buttock augmentation in 2004 with another physician in the subcutaneous plane. Over time, she noted a bottoming out of her implants

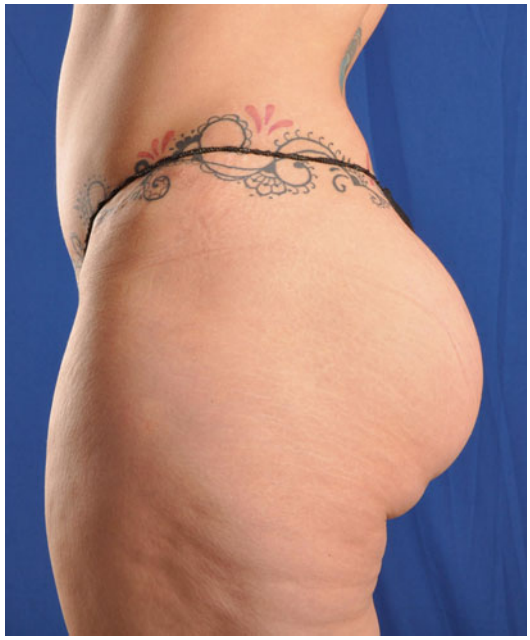


Fig. 6.27 A 32-year-old female had undergone buttock augmentation in 2006 with another physician in the subcutaneous plane. Over time, she noted drooping in the buttock to the point of creating a double-bubble deformity in the inferior aspect of her butt

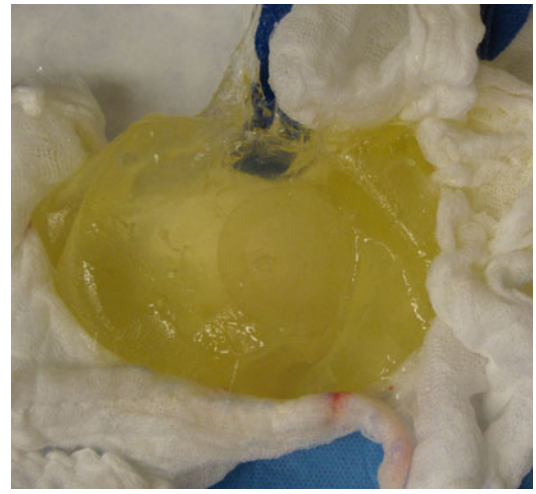


Fig. 6.28 Ruptured cohesive gel implant after removal from the patient's buttocks. She had undergone augmentation in South America and presented because of significant hardening of the buttocks with the left being harder than the right. The left buttock implant was noted to be ruptured

Implant Rupture

Implants used in the early days of buttock augmentation, typically breast implants, were filled with liquid silicone and were subject to rupture (Fig. 6.28) [32]. Since that time, the majority of US surgeons have begun performing buttock augmentation with semisolid elastomer implants which do not have a gel component. While the implants used in our practice cannot be ruptured, fractures of the implant are possible.

Scar Hyperpigmentation and Hypertrophy

The key to reduction of these problems is careful layered closure. Patients with a history of keloid or hypertrophic scar formation may require the use of steroid injected at the site of incision. Careful layered closure can produce very aesthetically pleasing scars that are difficult to notice. In addition, the use of silicone gels and silicone sheeting may help patients achieve nearly "invisible" postoperative scars (Fig. 6.29).

Capsular Contracture

This is a possible late sequela of any implant placement, most frequently described in the breast augmentation literature. In the buttock augmentation literature, the rate is typically noted to be about 1–2 % [15, 30]. In the event that a patient presents with signs/symptoms of capsular contracture (e.g., induration of the implant site, tightness in the leg, new onset pain, new onset swelling), ultrasound or CT evaluation of the affected extremity is warranted. If a capsule is identified, typically characterized by calcifications, then a partial or complete capsulectomy is warranted (Fig. 6.30). Capsular contracture is best prevented by meticulous hemostasis, good sterile technique, and avoidance of bleeding in the postoperative period. In 2012, the primary author defined a staging system for capsular contracture to better define the entity (Table 6.6).

In 2012, the authors sought to evaluate the results with buttock augmentation and the incidence of capsular contracture. It was noted that with respect to capsular contracture, there

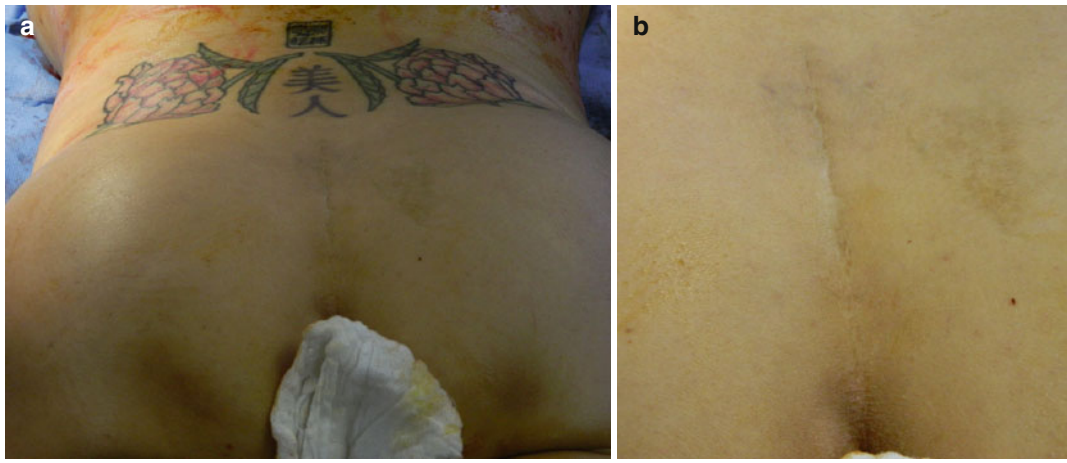


Fig. 6.29 (**a**, **b**) A 34-year-old patient 1 year post-gluteal augmentation. Closure was performed in a subcuticular fashion with the use of silicone on the incision for months 2–4 to improve scar quality

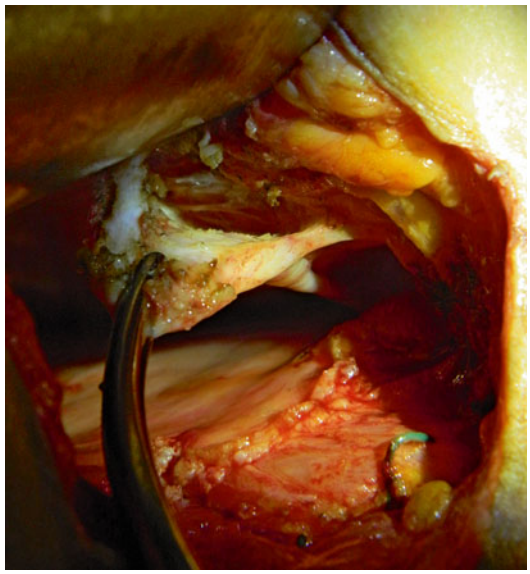
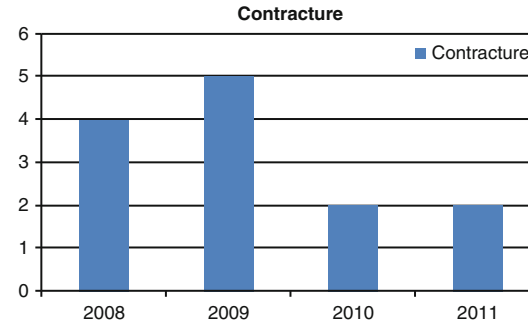


Fig. 6.30 Capsulectomy being performed in a patient who developed significant capsular contracture. The Kelly is grasping the capsule and electrocautery is used to free it from surrounding tissue

Table 6.6 Chugay staging system for capsular contracture with buttock implants

Grade of contracture	External deformity	Implant displacement
I	Firmer buttock but no deformity	None
II	Palpable hardening of buttock	Minimal or none
III	Minor external deformity	Moderate
IV	Marked external deformity	Severe

Table 6.7 Incidence of capsular contracture as noted in the authors' series from 2008 to 2011. There is note of decreased incidence of capsular contracture with time



was an overall rate of 13.5 % (13/96) over the 4-year period [35]. However, over that period, there was a drop in the rate of capsular contracture from an average of 4.5 contractures/year in 2008 and 2009 versus 2 contractures/year in 2010 and 2011 (Table 6.7). To minimize capsular contracture, a much stricter and more regimented postoperative care plan was utilized for the patients that began in late 2009. Patients were asked to sleep on their back 2 h/night for 6 months beginning at week 2. This helps keep

the implant pocket soft and allows the pocket to be stretched out adequately. In addition, a 7–10-day course of postoperative antibiotics is prescribed, and the pocket is irrigated with antibiotic solution to take the bacterial load as low as possible, which has been suggested as a possible source of capsules. JP drain suction is maintained until drainage is less than 30 mL/24-h period for 48 h. While these measures do not eliminate the possibility of having a capsular contracture, the authors believe that the results demonstrate a decreased incidence.

Case 1

A 35-year-old female underwent buttock augmentation with a previous physician. She presented with significant capsule formation in the left buttock with noted asymmetry. She underwent removal of old implants, left-sided capsulectomy, with placement of new style 3, size 3 implants. During the operation, she was noted to have significantly thickened capsule below the muscle. There was some residual serous fluid in the pocket which leads one to believe that seromas and hematomas may play a large role in capsule formation. Using a combination of sharp dissection with electrocautery and blunt dissection with a Lareux tissue dissector, the capsulectomy was completed (Figs. 6.31 and 6.32). The capsule was noted to be significantly thickened, measuring approximately 1 cm (Fig. 6.33).

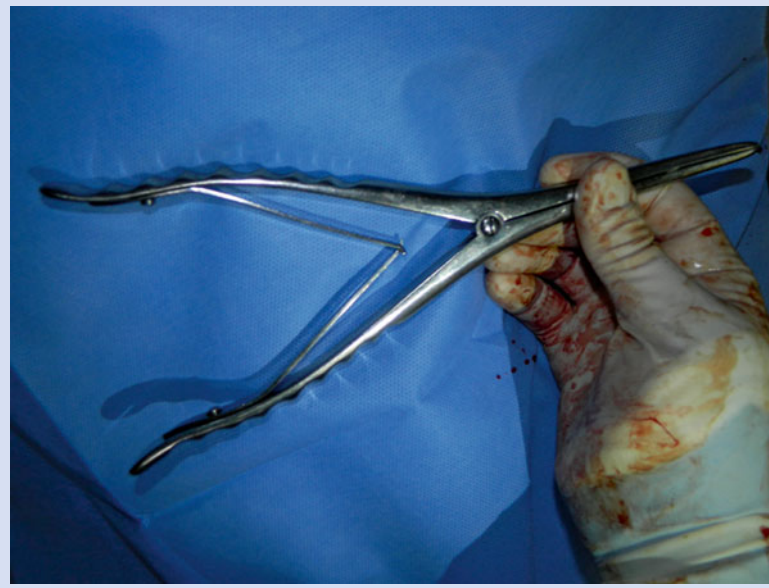


Fig. 6.31 Lareux tissue dissector

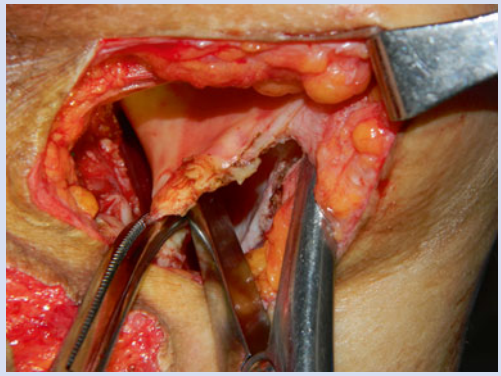


Fig. 6.32 Dissection of capsule away from surrounding muscle using sharp dissection with electrocautery and Lareux tissue dissector

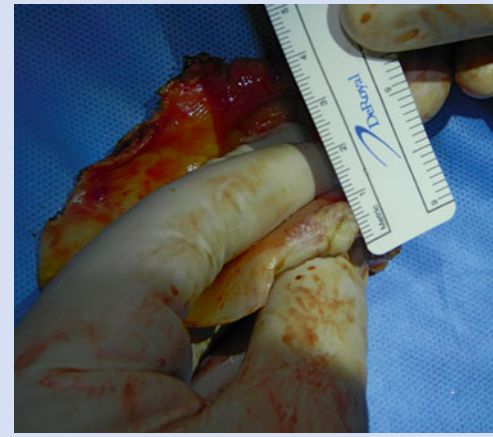


Fig. 6.33 Capsule from patient undergoing buttock capsulectomy for capsular contracture. The capsule measures approximately 1 cm in thickness

Wound Dehiscence

In the field of surgery, wound dehiscence is typically a product of surgeon error and poor attention to wound closure. It may also be produced by inadequate blood supply or due to excessive tension at the site of the incision. In the case of buttock augmentation, the cause is likely an amalgam of these. Bruner et al. [36] proposed that the cause of dehiscence in buttock augmentation is that the site of the incision is a "watershed" area with no perforating vessels in the area overlying the sacrum. The blood supply to the healing wound is entirely based on small capillaries that approach the midline from the lateral aspect. He then recommends that to minimize the risk of dehiscence, one must be delicate with the tissues at the site of the incision, avoiding desiccation and excessive traction. There is little that the physician can do to combat the marginal blood supply to the healing wound. Therefore, in the authors' estimation, the best way to prevent this complication is meticulous closure in three layers: fascia, deep dermis, and skin. Mendietta [23] also noted that dehiscences are significantly increased in overweight patients and also in patients in which an implant of more than 350 cc or more than 3.5 cm projection is used. His data demonstrates an 80 % dehiscence rate in this population. For this reason, he uses intraoperative tissue expansion while dissecting the contralateral side. If the muscle still cannot be closed with minimal tension, a smaller implant must be used. This means that it is incumbent on the surgeon to properly select the appropriate patient for buttock augmentation and to choose the implant that best suits the patient without being overly large and risking wound dehiscence.

It is very common in buttock augmentation to have small segments of dehiscence due to the significant tension on the incision in the gluteal region (Fig. 6.34). The first large volume studies on buttock augmentation by Mendietta [31] and Gonzalez [22] reported wound dehiscence rates of between 14 and 30 %. The authors' work in buttock augmentation, noting a dehiscence rate of 14.5 % (14/96) over a 4-year study period, coincides with the work of Mendietta and Gonzalez and relates solely to intermuscular placement of the gluteal prosthesis [35]. Dehiscences in the study were defined as any break in the gluteal incision, ranging from 1 to 5 cm in size. A recent study of 200 gluteal augmentations by Senderoff [30] reports a dehiscence rate of 1.5 %. However, the surgeon admits that the vast majority of his cases were performed

Fig. 6.34 Wound dehiscence. (**a**) Small (<2 cm). (**b**) Medium (2 cm). (**c**) Large (>2 cm)

in the subfascial plane, putting less tension on the intergluteal fold incision due to small implant sizes and potentially skewing his dehiscence rate. Therefore, depending on the plane of dissection, implant size used, and method of closure, there is a wide variability in dehiscence rates noted for gluteal augmentation.

Nerve Injury

Although frank paresis has yet to be described in the literature, there is no doubt that there is always a potential for injury either to the gluteal nerves due to their close proximity to the sacrum at the site of entry into the subgluteal plane or to the sciatic nerve in dissection of the submuscular pocket. Mendieta [31] reported a 20 % risk of transient sciatic paresthesias postoperatively, likely due to traction injury on the sciatic caused by significant pocket manipulation. If a patient has persistent discomfort, gabapentin (Neurontin) or pregabalin (Lyrica) may be considered to treat neuropathic pain. Gabapentin works by blocking voltage-dependent calcium channels, modulating excitatory neurotransmitter release. Pregabalin works by binding alpha 2-delta subunits of calcium channels and thus reduces neurotransmitter release. Treatment on either of these medications is typically continued for 1 month and patient results are evaluated at that time. Prior to discontinuation of the medication, the dosage should be tapered over the course of a week.

Pulmonary Embolism

Although this is a potential risk with any surgery performed due to the increase in stasis of the blood and the increased inflammation due to surgery, it has been a rarely reported phenomenon. In addition, patients undergoing liposculpture and fat-grafting procedures are at risk of fat emboli. These phenomena may have a low

incidence that may just be due to the fact that most cases are subclinical and do not present to the attention of the surgeon. Cardenas-Camarena in 1999 [37] reported 1.5 % (1/66) incidence of fat embolism. Most large volume studies on fat emboli reveal an incidence of less than 1 % in retrospective studies and a mortality of 10–15 % in fulminant cases [38, 39].

Compartment Pressure Problems/Compartment Syndrome

Compartment syndromes, typically seen in trauma, involve an acute increase in pressure inside a closed space, thereby impairing blood flow to the affected space and potentially putting the limb at risk for loss. Clinical signs of compartment syndrome include the six Ps: pain, poikilothermia, pallor, paresthesias, paralysis, and pulseless. In conscious patients, pain out of proportion to examination is the prominent symptom. Pain with passive range of motion is particularly troubling. Although rare, gluteal compartment syndrome has been reported in the literature and has been attributed to trauma, vascular surgery, intramuscular drug abuse, altered level of consciousness from alcohol ingestion or drug overdose, prolonged immobilization, epidural analgesia after join arthroplasty, and infection [40]. In a meta-analysis of 28 cases, Henson et al. [9] note that 46.4 % of cases were diagnosed based on measuring compartmental pressures in addition to the constellation of physical findings, while 54 % were diagnosed purely based on clinical findings. This points to the fact that a physician who is aware of the potential complication can diagnose the matter without resorting to advanced testing or diagnostic assays, especially considering that there is no known pressure threshold to definitively diagnose gluteal compartment syndrome. In the cases of compartment syndrome noted in the medical literature, when compartment pressures were obtained, a compartment pressure above 30 mmHg measured with a Stryker monitor was felt to be indicative of compartment syndrome. Nonoperative treatment was used in 28.6 % of cases reviewed. The treatment of gluteal compartment syndrome is at the discretion of the treating surgeon making nonoperative management a viable option as long as close follow-up can be performed; but expeditious removal of the implant is the treatment of choice.

Discussion

Over the course of the authors' time working with gluteal implants, there are several recommendations that seem to be useful in standard practice:

1. Use of the subgluteal plane (intermuscular plane) for implant placement [17]. Authors have suggested various planes for implant placement and each has its own disadvantages. Surgeons who use the subcutaneous space are bound to have bigger problems with implant migration, implant palpability, and capsular contracture [14, 15]. The submuscular plane, as described by Robles [13], carries significant risks for damage to the sciatic that are unnecessary in gluteal augmentation surgery. The intramuscular plane, as espoused by Vergara [18], allows for complete coverage of the implant with less chance of palpability, giving a much more natural and long lasting result for gluteal augmentation. However, the intermuscular plane, in the authors' experience, avoids unnecessary injury to the gluteus maximus muscle that may occur with the creation of the intramuscular plane.
2. Use of the intergluteal fold incision. While some surgeons have suggested use of infragluteal cleft incisions, others have recommended incisions to each side of the midline. It is the authors' feeling that a single incision in the intergluteal fold is not only the most aesthetically pleasing but one that lends itself to less morbidity and disruption of the natural anatomy.
3. Placement of a bulb suction drain and maintenance until drainage is less than 30 mL/24-h period for 48 h consecutively. While this typically only remains in place for 1 week, there have been some patients who had long-standing drainage and would otherwise have developed seromas in all likelihood with early

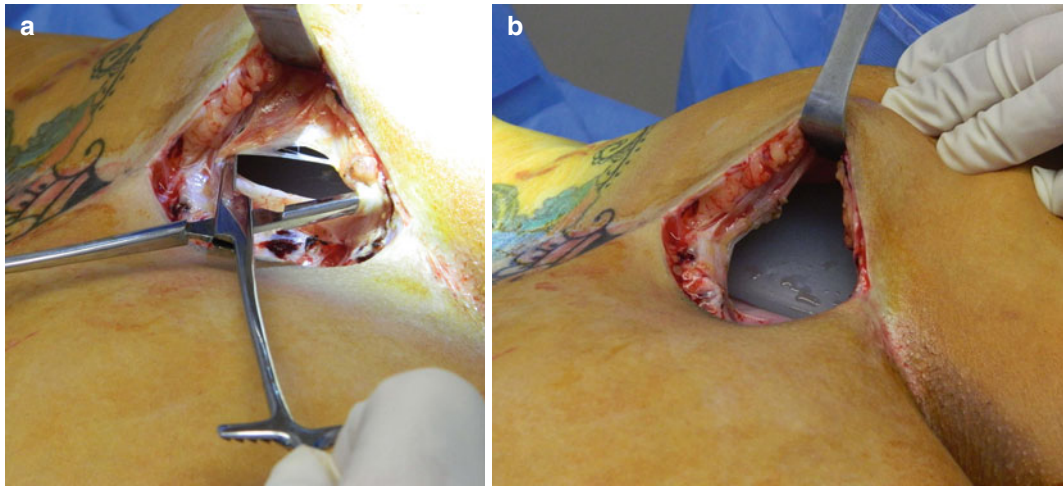


Fig. 6.35 (**a**) The implant pocket is identified and opened using a Kelly clamp to permit full visualization of the implant and facilitate removal. (**b**) The implant in its subcutaneous pocket

drain removal. We ask patients to record drain outputs twice a day and instruct patients and caregivers on proper drain care (e.g., stripping of the tubing and maintaining the bulb to suction) and recording of outputs.

Transitioning from a Subcutaneous Implant Position to Intermuscular Implant Position

The authors have seen many patients that present after having had a buttock augmentation in the subcutaneous plane and note a sagging of their buttocks within 10 years of their previous surgery. They present wanting to have their buttocks lifted and wish to regain their more youthful appearance. In managing these patients, one must be very meticulous in the operation to achieve good results that improve the patient's presenting condition.

The operation is begun by excising the existing scar in the patient's intergluteal fold. Next, subcutaneous dissection is carried to the existing implant capsule using electrocautery. The pocket is then entered and the old implant removed (Fig. 6.35). Any serous fluid that may be in the pocket is evacuated with suction. At this point, one can clearly see nothing but skin, subcutaneous tissue, and anterior capsule wall as being the only support for the implant and one begins to better understand why implant descent and drooping may occur (Fig. 6.36). An anterior capsulectomy is performed to remove the capsule as leaving it may result in a seroma in that space (Fig. 6.37). An alternative option, for those who do not feel comfortable performing a capsulectomy, may be scarification of the capsule in the hope of creating a raw surface that will better collapse postoperatively (Fig. 6.38).

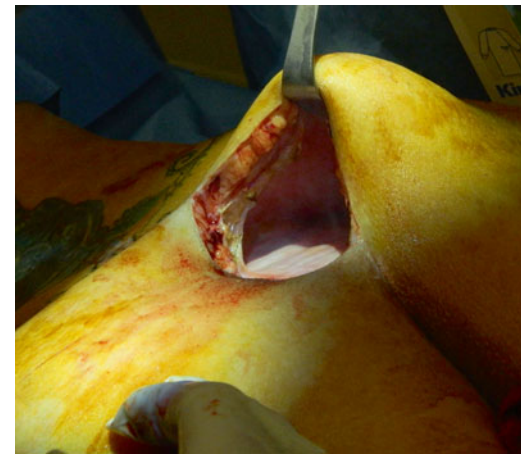


Fig. 6.36 The subcutaneous implant pocket with nothing but skin, subcutaneous tissue, and anterior capsule wall supporting the implant explaining why drooping can frequently occur with subcutaneous implant placement

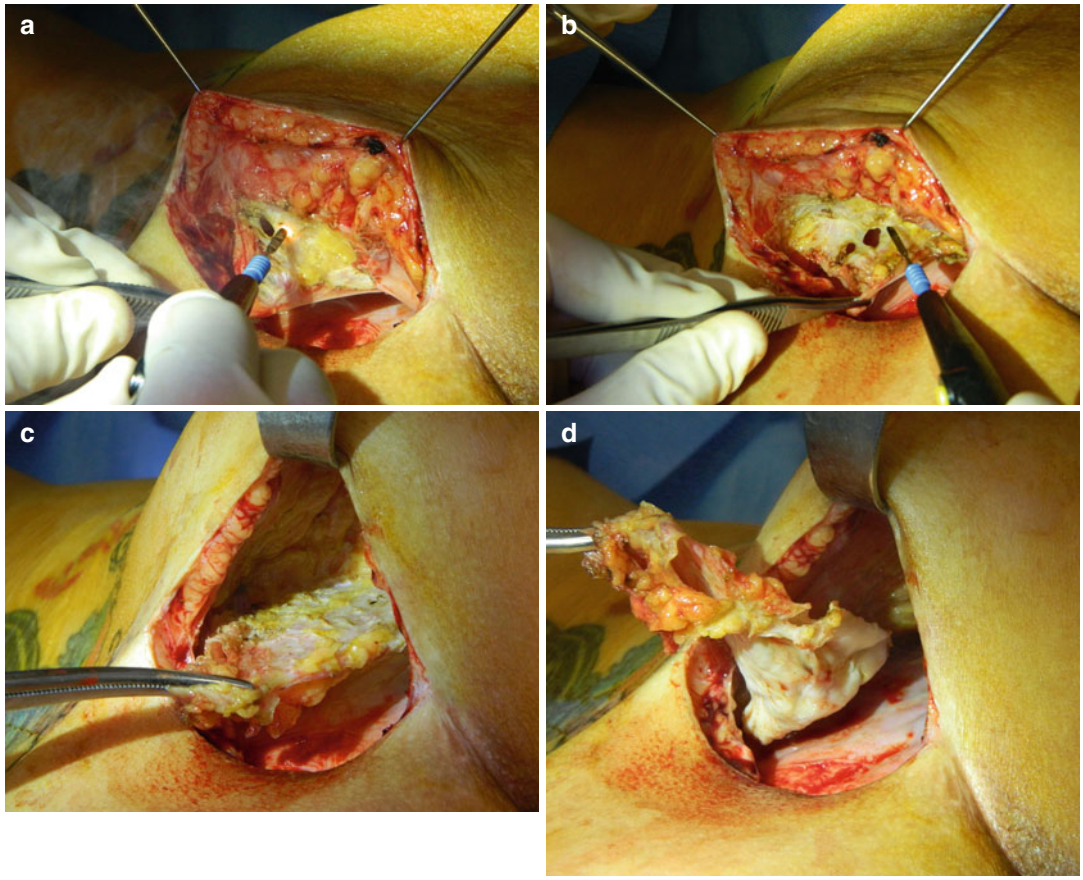


Fig. 6.37 (**a**) Beginning of capsulectomy with forceps grasping the capsule, placing traction on it and allowing for a better definition of the plane between the capsule and subcutaneous tissues. (**b**) Further dissection along the capsule using electrocautery. Small tears in the capsule may occur in trying to maintain a close dissection along the capsule wall. The surgeon should take care to minimize excess tissue removal as this may predispose the patient to a more palpable implant. (**c**) Near-complete dissection of capsule. At this point using a Kelly clamp to grasp the capsule is of great help. (**d**) Anterior capsule just prior to excision

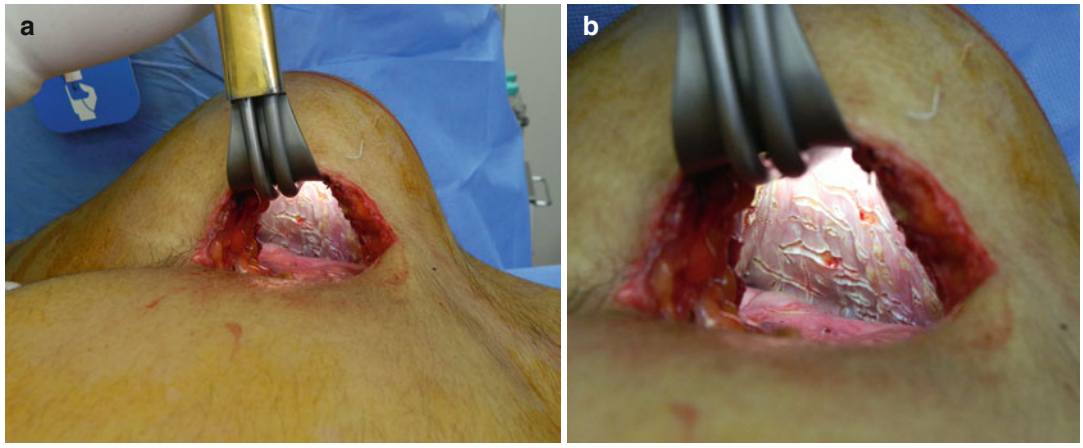


Fig. 6.38 (**a**) Scarification of the anterior capsule wall rather than capsulectomy. This may be a preferred means of capsule management in the already thin patient with thin tissues. (**b**) Close-up of the anterior capsule wall that has been scarified with electrocautery

After the management of the anterior portion of the capsule is complete, the posterior wall of the capsule is entered. Dissection through the capsule and muscle is then continued with a curved hemostat to achieve an intermuscular position (Fig. 6.39). This pocket is then dissected as done in a routing gluteal augmentation (intermuscular position). Prior to placement of the implant, a drain is placed into the newly created intermuscular plane with the tip of the drain extending through the old posterior capsule wall and into the old capsule space (Fig. 6.40). By placing the drain in this manner, one can decrease the risk of seroma formation not only around the implant but also in the old capsule space. The gluteus maximus muscle and posterior capsule wall are approximated as much as possible over the newly placed implant. Due to tension and tearing of the capsule, it may not be possible to completely incorporate all of the old posterior capsule wall. However, one should take care to create a secure and complete closure overtop the implant (Fig. 6.41). Closure of the remainder of the wound is as described in a routine gluteal augmentation.

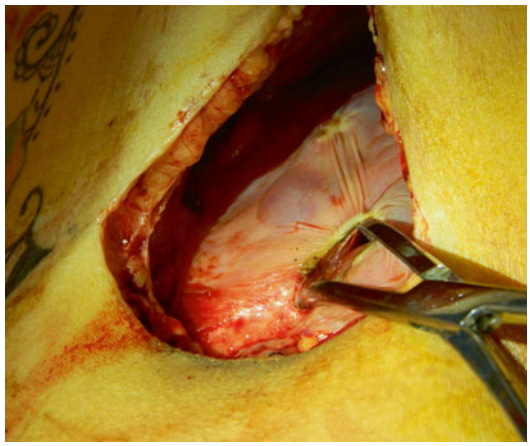


Fig. 6.39 Small incision in the posterior capsule wall was made with electrocautery, and now a hemostat is used to spread the capsule and underlying gluteus maximus to achieve an intermuscular position for implant placement

Adjunct Procedures for Gluteal Augmentation

When considering the patient for gluteal augmentation, the surgeon should evaluate the areas surrounding the buttocks for possible liposculpture or other adjunct procedures. Patients seeking augmentation of the buttocks frequently have lipohypertrophy of the flanks, sacrum, and thighs that may need attention to better define the contour of the buttocks and achieve a more aesthetic appearance [41]. Liposculpture to these areas frequently can help to better define the gluteal aesthetic units. This is especially true when performing liposuction of the flank and lower back region, which can provide a gentle "S curve" to the lower back along

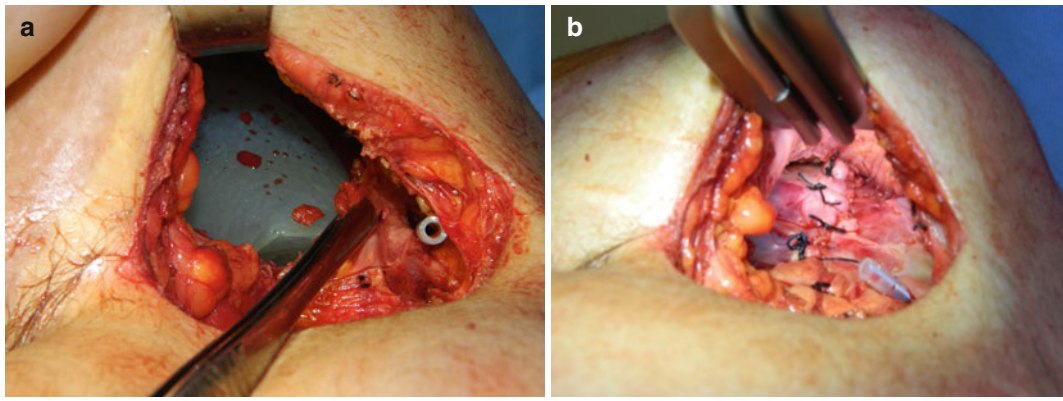


Fig. 6.40 (**a**) Drain beneath the newly placed implant and extending into the subcutaneous space and site of previous capsule. (**b**) With the capsule and muscle approximated, one can now see the tip of the drain in the subcutaneous space preventing seroma formation in the site of the previously excised capsule

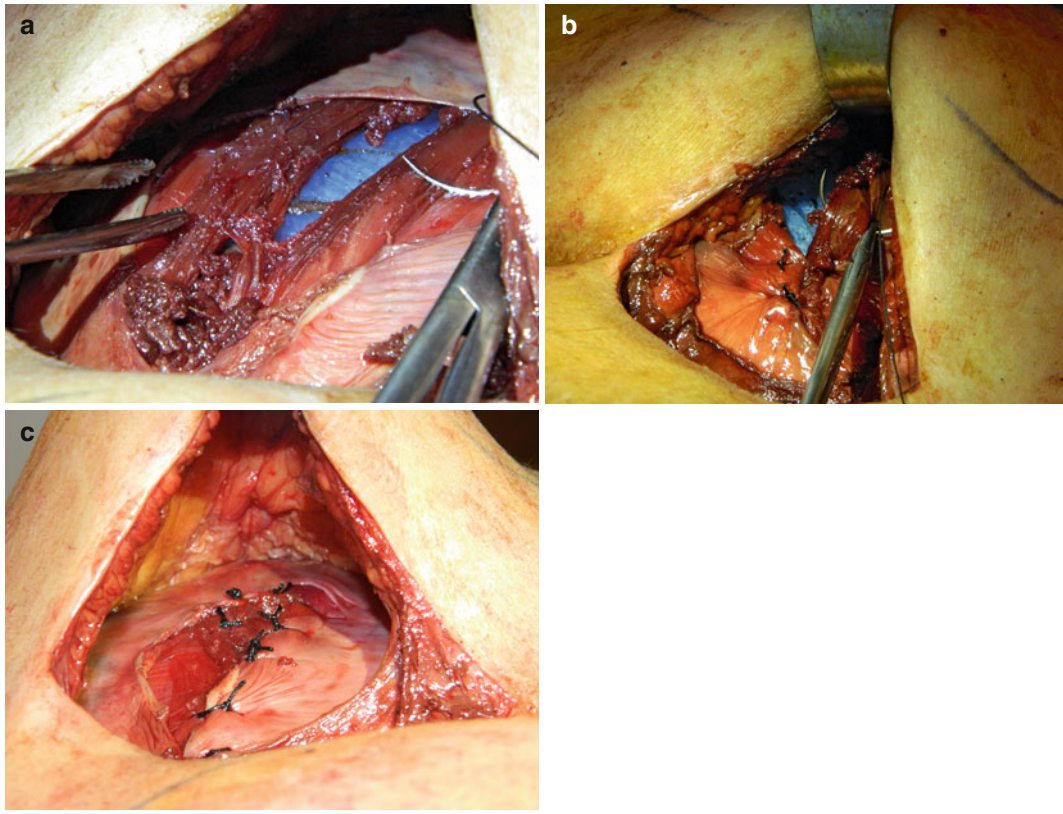


Fig. 6.41 (**a**) This demonstrates the first stitch being placed to approximate the gluteus maximus muscle and posterior capsule wall over the newly placed intermuscular implant. (**b**) Further closure of the muscle and capsule over the implant. (**c**) Final closure over the implant. Note that there are sections of the capsule that are not incorporated as attempts to bring them into the closure produced tearing of the capsule

with a narrowed waist, hence accentuating the new fullness of the buttocks. One caveat to this is that the surgeon must be careful to minimize aggressive liposuction in the area of the banana roll, as the tissues at the level of the infragluteal crease are the insertion for the fascia that surrounds the buttock muscle. Disruption of this fascia can in essence destroy the "pillars" of the buttocks and place the patient at increased risk of buttock ptosis over the crease. Another caveat is that the surgeon cannot be overly aggressive in liposuction of the presacral area at the time of simultaneous implant augmentation as there may be excessive trauma to the area which could compromise the vascular supply and significantly increase the chance of postoperative wound dehiscence.

Another adjunct procedure to consider is fat grafting to the lateral hip region overlying the trochanters to help produce a more aesthetic "S curve" in the lateral hip region. While the trochanteric depression is a natural anatomic entity, some people find it unsightly and wish to achieve a more rounded appearance to the lateral hip area [42]. Fat is an excellent means of correcting this deformity if it is available. Another option, if there is a lack of fat, would be consideration of a hip implant. While it is possible to place a hip implant over a significantly depressed trochanteric region, we recommend performing this at a separate sitting from the buttock augmentation to minimize the risk of creating one large open space between the buttocks and lateral hip region (Fig. 6.42).

One may consider a buttock lift in the gluteal region if there is a significant ptosis. Ptosis will not be corrected with a buttock implant. However, a patient who has buttock hypoplasia and ptosis may be a good candidate for both an implant and a buttock lift to eliminate a sagging bottom side.

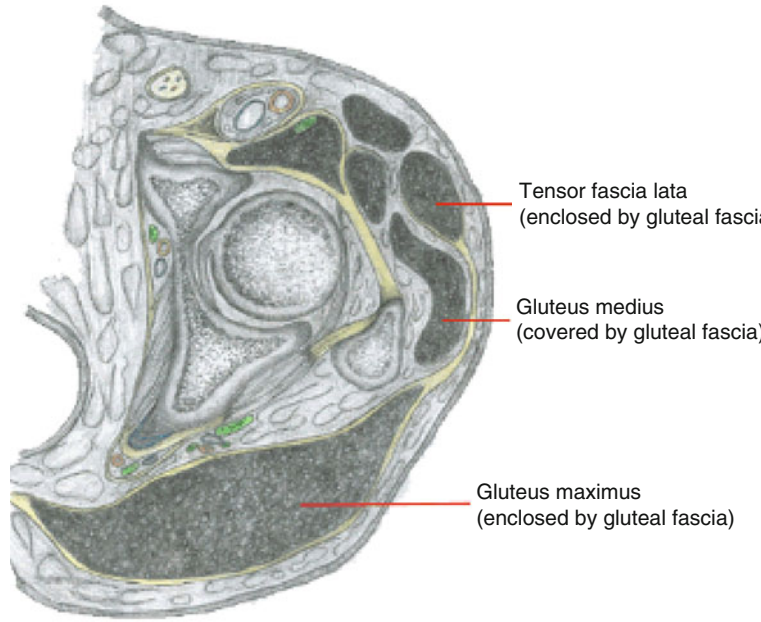


Fig. 6.42 Axial section displaying the gluteus maximus and medius muscles and their relationship to the tensor fascia lata. All of these muscles are in close proximity, and for this reason, dissection for a simultaneous hip and buttock augmentation may leave one large open space, potentially leaving the patient at risk for seromas, implant migration, and a larger chance for infection. Because of these anatomic relationships, the authors rarely perform simultaneous buttock and hip augmentations

Buttock Augmentation with Fat Grafting Compared to Implant Augmentation

The topic of the "Brazilian butt lift" and using patient's own fat to augment their bottom side has been a hot one in aesthetic surgery within the past decade (Fig. 6.43). Since the advent of liposuction, surgeons have been working to contour the body with removal of localized adiposities. The work of Sydney Coleman in the field of fat grafting has helped to propel the use of fat to augment everything from the face and hands to the butt [41, 43, 44]. Coleman's work with fat and long-term studies on permanence of the effect of grafting then pushed other surgeons to start grafting more frequently to the buttocks with significant improvement in gluteal contour [37, 45–51]. Cardenas-Camarena [37] was one of the first to report on his work. He evaluated his work with lumbosacral liposuction and fat grafting to the buttocks and found that with a mean fill of 210 mL (range 120–280 mL), it had significant improvement with excellent patient satisfaction.

Some patients who present to consultation have fat excess or lipohypertrophy in the flanks, hips, thighs, back, and/or abdomen and would benefit from liposuction. This fat can then be used to augment a hypoplastic or deflated gluteal area as opposed to using a prosthesis (Fig. 6.44). When considering a patient for augmentation gluteoplasty with fat grafting, there are several factors that must be considered by the surgeon:

Fig. 6.43 Injection of fat into the gluteal region for an improved volume using a 3-mm cannula. Injection directly into the muscle proper will produce an increase in overall volume, while more superficial and peripheral injection will help to define the gluteal region and provide better shape

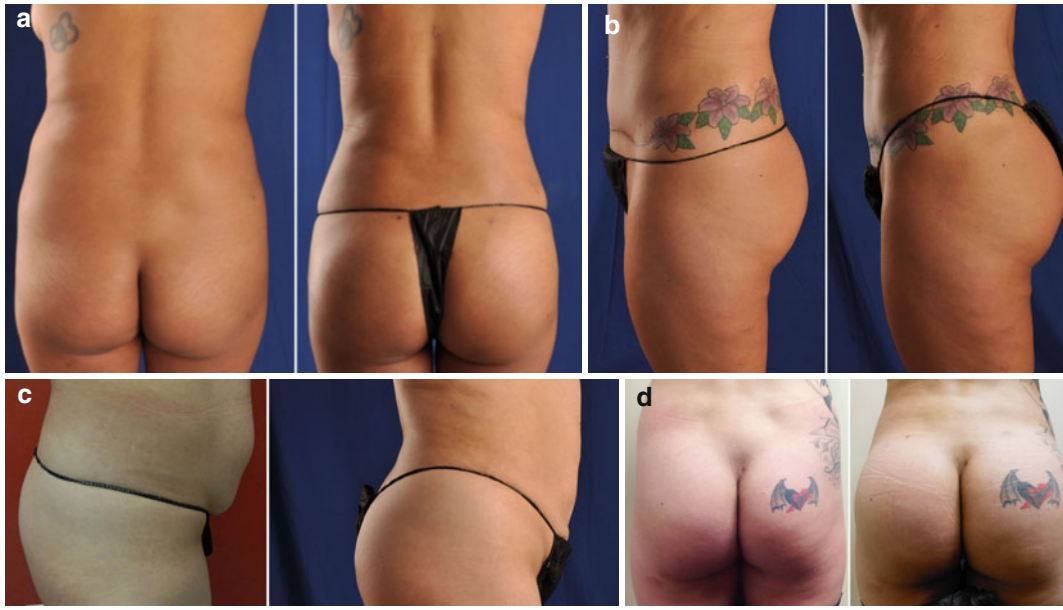


Fig. 6.44 Examples of patients undergoing buttock augmentation with fat grafting. (**a**) Patient 1 month after liposuction of the hips and back and fat transfer to butt (270 mL per buttock). (**b**) Patient 3 months after liposuction of the hips and fat transfer to the butt (235 mL per buttock). (**c**) Patient 1 month after liposuction of the abdomen and hips with fat transfer to butt (290 mL to left buttock and 270 mL to right buttock). (**d**) Patient 1 month after liposuction of the abdomen and hips and fat transfer to buttocks (410 mL to left buttock and 420 mL to right buttock)

1. First, a patient who has very little fat and cannot at least provide 300 mL of clean fat per buttock for augmentation should be dissuaded from using fat as a means of performing gluteal augmentation. In a comparative study performed at our institution, we found that patients had a mean of 280 mL grafted to each buttock (range of 30–600 mL per buttock) and achieved satisfactory results in 69.7 % of cases (23/33) [35]. Those patients who were not satisfied postoperatively were largely dissatisfied with the amount of augmentation produced; and, of those patients who were dissatisfied, it was noted that they had smaller volumes (typically less than 250 mL) grafted. Bruner and others with large volumes of buttock augmentations with autologous fat support the use of larger volumes in order to achieve aesthetically pleasing outcomes, recommending volumes of 500–900 mL of grafted fat per buttock in some cases [20, 36, 51]. While some might feel that 300 mL is an inadequate volume for augmentation, the authors feel that it maximizes aesthetic result and minimizes the risk of complications that can be seen with larger volume augmentations in the range of 500–900 mL. Some surgeons have even achieved grafts over 1,000 mL per buttock; however, it is clear that this is associated with a much higher risk of infection at the graft site and seroma formation at the harvested sites [36, 51]. For this reason, the authors discourage this practice.
2. This then brings up the second point of consideration which is the unpredictable nature of "fat take" in grafting procedures. To date, only one study has truly sought to quantify fat that was resorbed after buttock augmentation with autologous fat grafting by performing serial MRI examinations of the buttocks [51]. Unfortunately, only six patients were studied making actual quantification of fat survival near impossible. In studies performed by Coleman and others, there is an estimated typical take of fat between 50 and 70 % when stem cell therapy is not employed [36, 41, 43–45, 51]. Despite efforts to minimize trauma to the buttocks by direct pressure and the use of loose buttock compression garments, there is still no way to reliably produce a 100 % take of fat that is injected. For that reason, in order to increase the chance of "take" after fat grafting, the authors do

recommend the use of stem cell therapy for all fat-grafting patients. The authors employ Invitrx Therapeutics from Irvine, California. This is an independent laboratory that sends a technician to the office to process and purify the fat in a procedure that takes approximately 45–60 min. The physician can continue performing liposuction while the stem cell technician is processing the adipose tissue submitted to them at the onset of the case (at least 30 mL). After liposuction fat/aspirated adipose tissue and tumescent fluid is given to the technician, the adipose tissue is isolated from the tumescent fluid by centrifugation. Adipose tissue is treated with the enzyme collagenase and placed in incubation for 20 min to release adipose-derived stem cells. After incubation, to separate the enzyme from the adipose tissue and stem cells, the mixture is centrifuged again. The adipose tissue, enzyme, and stem cell pellet are separated in layers. To ensure the enzyme is fully removed from the fat, the fat and pellet are washed and rinsed with phosphate buffer saline and recentrifuged. The patient's own blood serum is added to the pellet to neutralize the enzyme. The processed fat along with the stem cell pellet is returned to the physician for implantation. After liposuction has been completed, the fat to be grafted is washed and then mixed with the harvested stem cells. While this does not ensure a 100 % take, it does increase the take of fat from the conventional 50–70 % up to 80 %, in the authors' practice [35].

3. A third point to consider is the level of vacuum applied by the suction apparatus. There has been some evidence to suggest that high vacuum levels may damage the fat cells and decrease their survival [45, 52]. For that reason, the authors do not exceed 25 mmHg on the suction apparatus. This use of aspiration at lower vacuum pressures is supported by Coleman [41, 43, 44], Pedroza [49], Bruner [36], and Murillo [51].
4. Grafting in small amounts and in variable layers. Coleman [27–29], Guerrerosantos [53], and Bruner [36] all agree that grafting in small quantities (<0.3 mL in each tunnel) improves the graft survival as there is more contact with adjacent blood supply. In addition to considering the quantity of the graft, the surgeon should aim to augment both the deeper muscular structures and the superficial structures. Addition of volume to the region is done at the level of the gluteus muscles, whereas shaping can be done with injection into the subcutaneous level. Injection in various layers also helps to spread out the grafted fat and increase the blood supply available to the grafted fat cells.
5. Postoperatively, the patient must be able to commit to 2 weeks without pressure on the buttocks. There is never an ability to achieve a 100 % fat take, but everything must be done to minimize trauma to the grafted fat. For that reason, it is recommended that the patients avoid sitting or sleeping on their back side for 2 weeks after surgery to minimize shear and compression forces.

In reviewing the authors' experiences with fat grafting and those of other physicians, the most commonly reported complications after fat grafting include infection, seromas, transient sciatic paresthesias, and tissue irregularities [33, 36, 50, 51]. Infection rates range between 7 and 18 % [36, 37]. Infection rates as high as 18 % are to be expected as every stage of harvesting, preparing, and grafting the fat has a potential for contamination [36]. This, when combined with a warm, moist, traumatized grafting environment, can help to explain why infections are a serious risk with fat-grafting procedures. Seromas are noted in areas of liposuction. Greater volumes of aspirate are more likely to result in a greater chance for seroma formation. Seroma rates vary from 6 % in Cardenas-Camarenas' work with fat grafts between 100 and 240 mL per buttock up to 40 % in Murillo's study that had average fat graft of 700 mL/buttock [20, 36, 37, 51]. In their most recent evaluation of seroma rates in their practice, Bruner [36] notes that he has seen a drop in seroma rates from approximately 40 % down to 2 % with the use of better compression in the sacral region along with closed suction drains (2) in the sacral region. Another complication often seen in fat-grafting patients is transient sciatic paresthesia. This tends to be described as minor discomfort associated with tingling and slight numbness along the course of the sciatic nerve, lasting less than 2 weeks in most cases [36]. The incidence is reported to be between 1 and 4 % [23, 51]. Bruner

[44] has made 12 mg of IV dexamethasone a routine at the beginning of the surgical procedure, hoping to minimize perioperative inflammation. As with neuralgia produced with implant augmentation, neuromodulators such as gabapentin and pregabalin are options in the recalcitrant patient.

In the only comparative study of gluteal augmentation (Table 6.8) that is available in the literature, the authors evaluated the results with implant augmentation against those with fat augmentation [35]. Over a 4-year study period, 129 patients underwent gluteal augmentation with either fat (33 patients) or implants (96 patients). The overall satisfaction of the patients receiving buttock augmentation was 76.0 % (73/96) for augmentation with implants and 69.7 % (23/33) for augmentation with fat, which was statistically significant ($P<0.001$; 95 % confidence interval [CI], 67.93–71.47). Seroma formation was more prevalent in the implant group (3.0 % versus 17.7 %; $P=0.02$; 95 % CI, 0.070–15.7). Lumps or dents were more prevalent in the fat-grafting group (33.3 % versus 2.1 %; $P<0.0001$; 95 % CI, 17.9–51.8). Complications isolated to those undergoing implant augmentation included dehiscence (14.6 %) and contracture (13.5 %). Ultimately, it was determined that although fat grafting for buttock augmentation is rising in popularity among surgeons, the results are not as consistent as those seen with buttock augmentation via implant. On the other hand, the consistency of results for implant augmentation is offset by the risk of capsular contracture and dehiscence, which are seen only in implant surgery. Regardless of the method of buttock augmentation chosen, surgeons can be confident that the results will be pleasing to the eye and to their patients as long as good surgical technique is used and the aforementioned perioperative risks are kept in mind.

Table 6.8 Summary data for 2012 buttock augmentation comparative study

Complications	Fat grafting ($n=33$)	Implant ($n=96$)	*P* value (CI 95 %)
Infection	1	12	0.09
Seroma	1	17	0.02
Rejection	N/A	1	N/A
Hematoma	1	0	<0.0001 (0.07–15.7)
Asymmetry	2	12	0.1
Scarring	2	1	0.003 (0.75–20.3)
Contracture	N/A	13	N/A
Post-op pain 8–10	9	20	0.37
Dehiscence	N/A	14	N/A
Lumps/dents	11	2	<0.0001 (17.9–51.8)
Satisfaction	23	33	<0.001 (67.9–71.8)

Table 6.9 Observed complications in buttock augmentation

Complication	Number ($n=450$)	Percent (%)
Seroma	74	16.44
Infection	52	11.56
Asymmetry	46	10.22
Wound dehiscence	74	16.44
Capsular contracture	51	11.33

Authors' Personal Experience

Since starting to perform buttock augmentation in 1995, the lead author (NVC) has performed approximately 450 buttock augmentation procedures, averaging approximately 25 augmentations per year. The overall satisfaction rate is 92.0 % (414/450). Patients who were dissatisfied primarily complained of an inadequate augmentation. Based on retrospective chart review, the most frequently encountered complications included seroma formation, infection, asymmetry, wound dehiscence, and capsular contracture. A patient was considered to have an infection if there was evidence of erythema around the wound or cellulitis requiring the physician to prescribe antimicrobial treatment or perform some surgical intervention. Wound dehiscence was broadly defined as any separation of the midline wound, with a maximal dehiscence of 5-cm, complete opening of the midline wound (Table 6.9).

Patient Cases

Case 2 (Fig. 6.45)
A 35-year-old female underwent buttock augmentation with a previous physician. She presented with significant capsule formation in the left buttock with noted asymmetry. She underwent removal of old implants, left-sided capsulectomy, with placement of new style 3, size 3 implants. The patient is seen preoperatively and 4 months postoperatively.

Fig. 6.45 (**a**) Preoperative. (**b**) Postoperative

Case 3 (Fig. 6.46)
A 44-year-old female underwent buttock augmentation with style 3, size 2 implants. The patient is seen preoperatively and 4 months postoperatively.

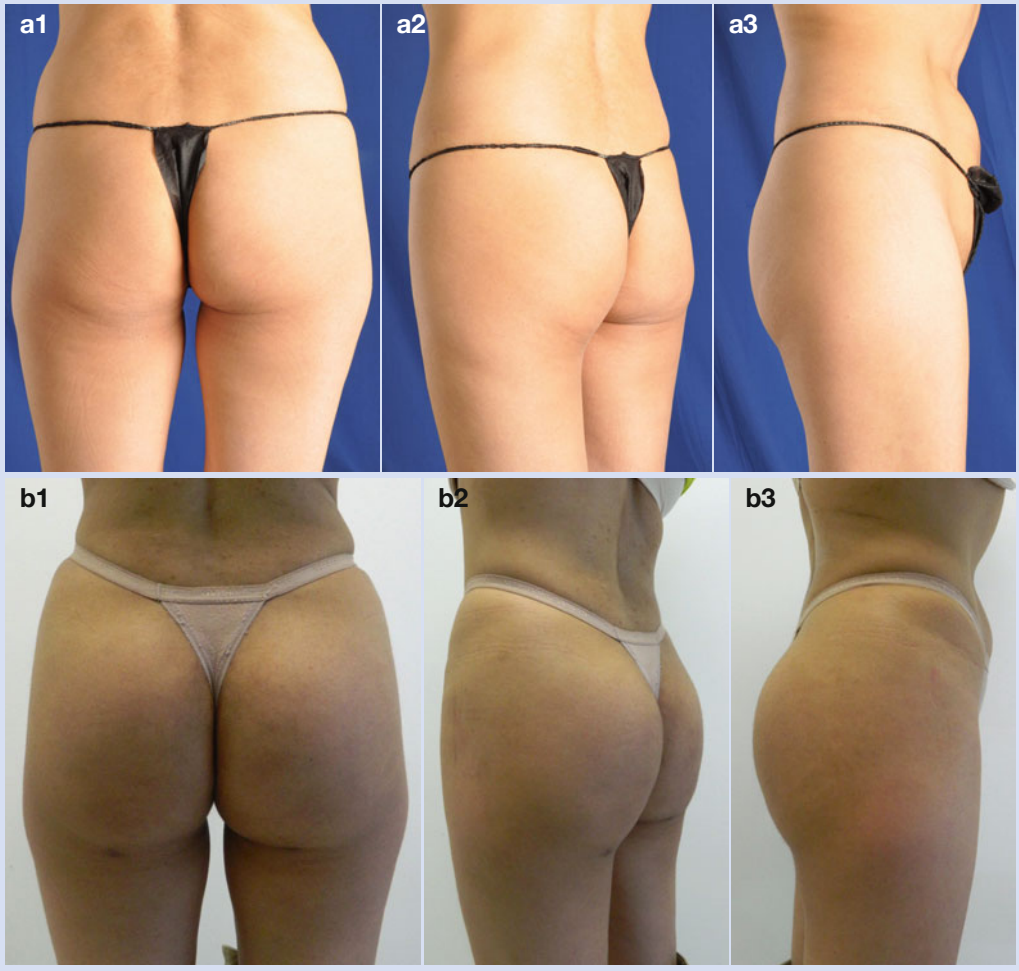


Fig. 6.46 (**a**) Preoperative. (**b**) Postoperative

Case 4 (Fig. 6.47)
A 61-year-old female underwent buttock augmentation with style 3, size 7 implants secondary to buttock hypoplasia. Patient seen preoperative and 1.5 months postoperative.

Fig. 6.47 (**a**) Preoperative. (**b**) Postoperative

Case 5 (Fig. 6.48)
A 45-year-old female underwent buttock augmentation with style 3, size 7 implants secondary to buttock hypoplasia.

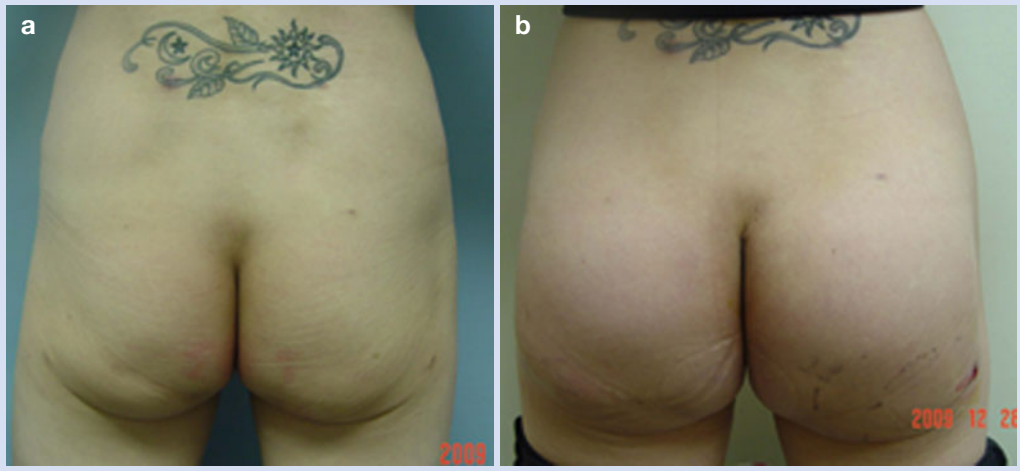


Fig. 6.48 (**a**) Preoperative. (**b**) Postoperative

Case 6 (Fig. 6.49)

A 31-year-old female underwent buttock augmentation with style 3, size 7 implants to achieve a more lifted and slightly more projected bottom side. She is seen preoperative and 3 months postoperative.

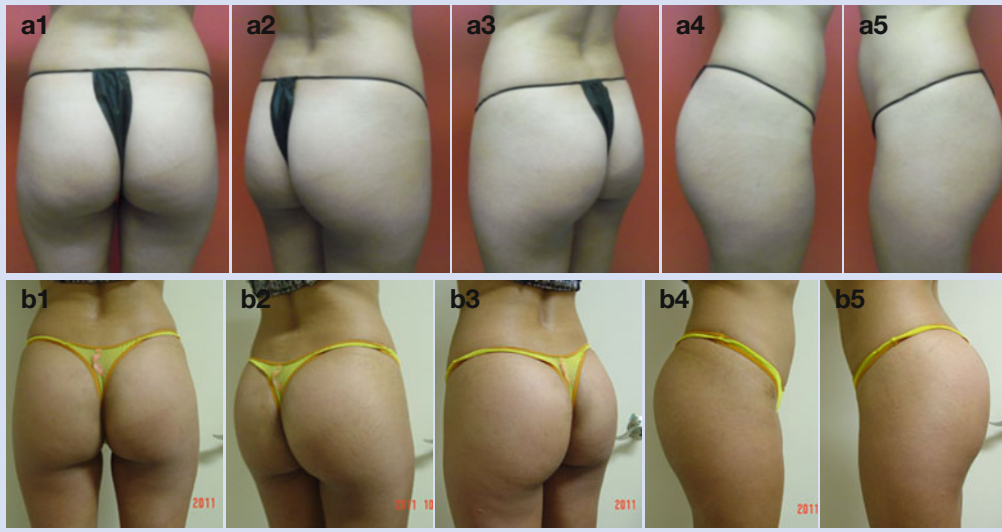


Fig. 6.49 (**a**) Preoperative. (**b**) Postoperative

Case 7 (Fig. 6.50)

A 30-year-old female underwent buttock augmentation with style 3, size 7 implants along with liposuction of the hips with aspiration of 400 mL fat. The patient is seen preoperatively and 2 months postoperatively.

Fig. 6.50 (**a**) Preoperative. (**b**) Postoperative

Case 8 (Fig. 6.51)
A 27-year-old female underwent buttock augmentation with style 3, size 8 implants. She is seen preoperative and 2 months postoperative.

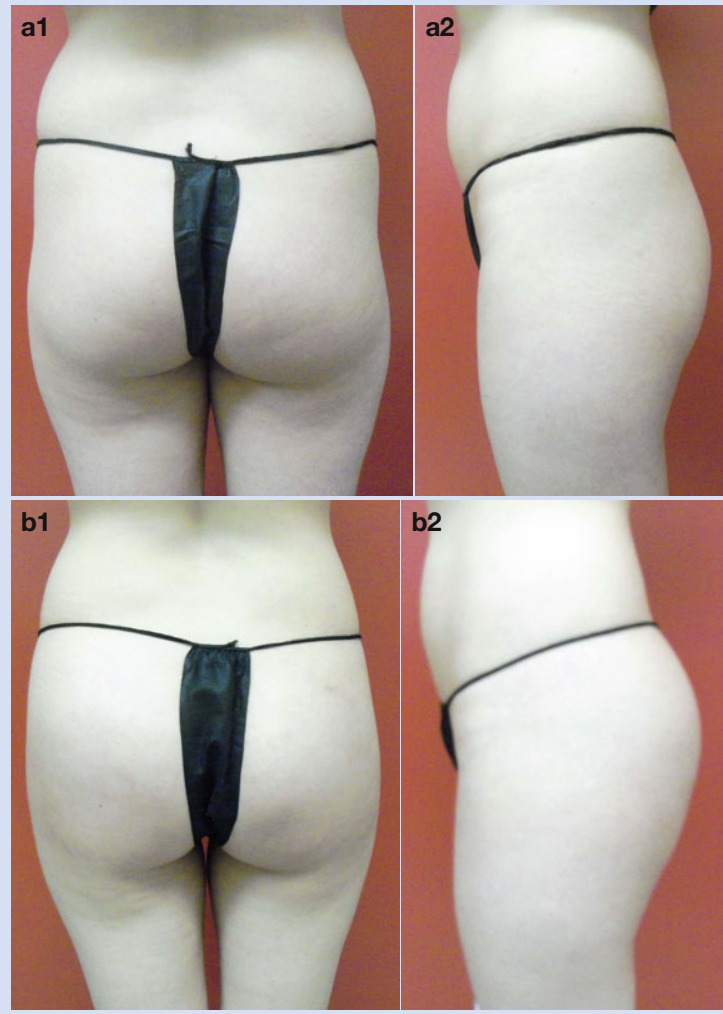


Fig. 6.51 (**a**) Preoperative. (**b**) Postoperative

Case 9 (Fig. 6.52)
A 21-year-old female underwent buttock augmentation with style 3, size 4 implants. She is seen preoperative and 1 month postoperative. The patient declined liposuction of the hips/flanks and thighs which may have improved her overall result.

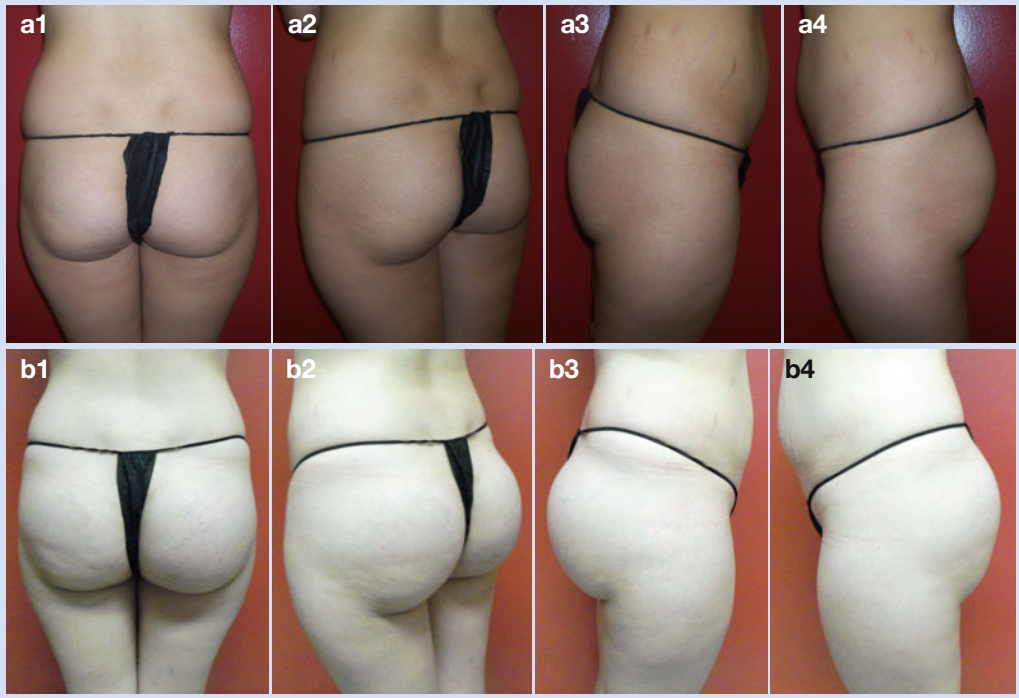


Fig. 6.52 (**a**) Preoperative. (**b**) Postoperative

Case 10 (Fig. 6.53)

A 38-year-old female underwent buttock augmentation with style 3, size 7 implants. Note excellent improvement superiorly but there is still deficiency in the lower buttock. This is typically corrected in later operations with liposuction and/or fat grafting as the implants do not extend so far caudally. The patient is seen preoperative and 2 months postoperative.

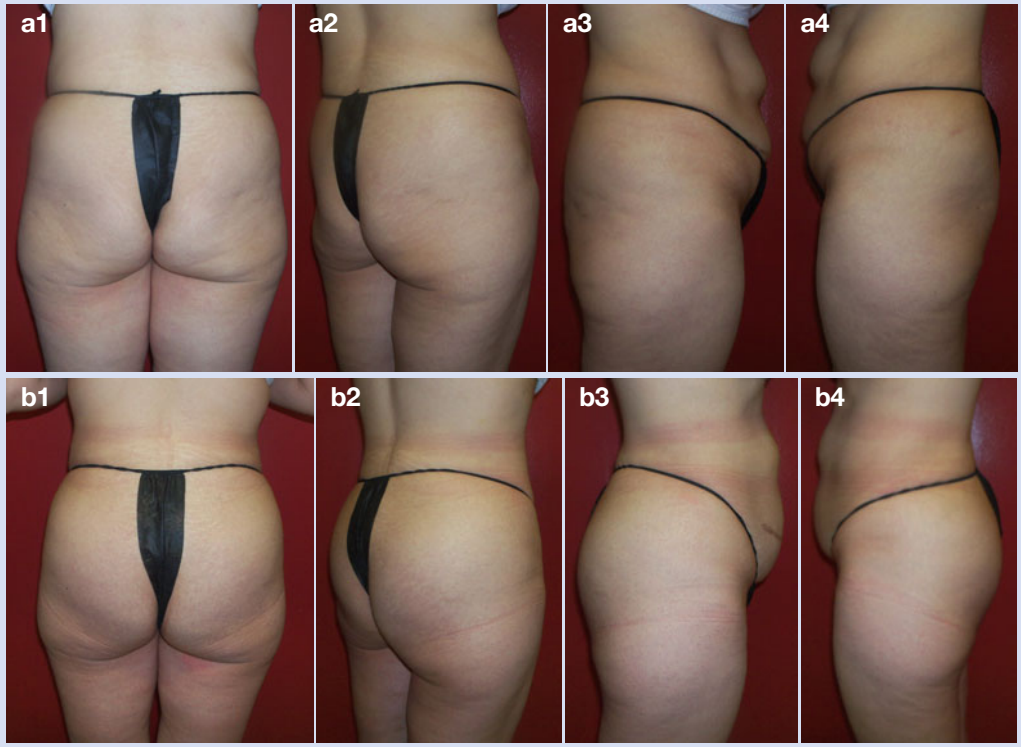


Fig. 6.53 (**a**) Preoperative. (**b**) Postoperative

Case 11 (Fig. 6.54)
A 40-year-old gay male presented with significant loss of volume in the buttocks after significant weight loss secondary to testicular cancer and his battle with HIV. He underwent augmentation with style 3, size 2 implants. The patient is seen preoperative and 2 months postoperative.

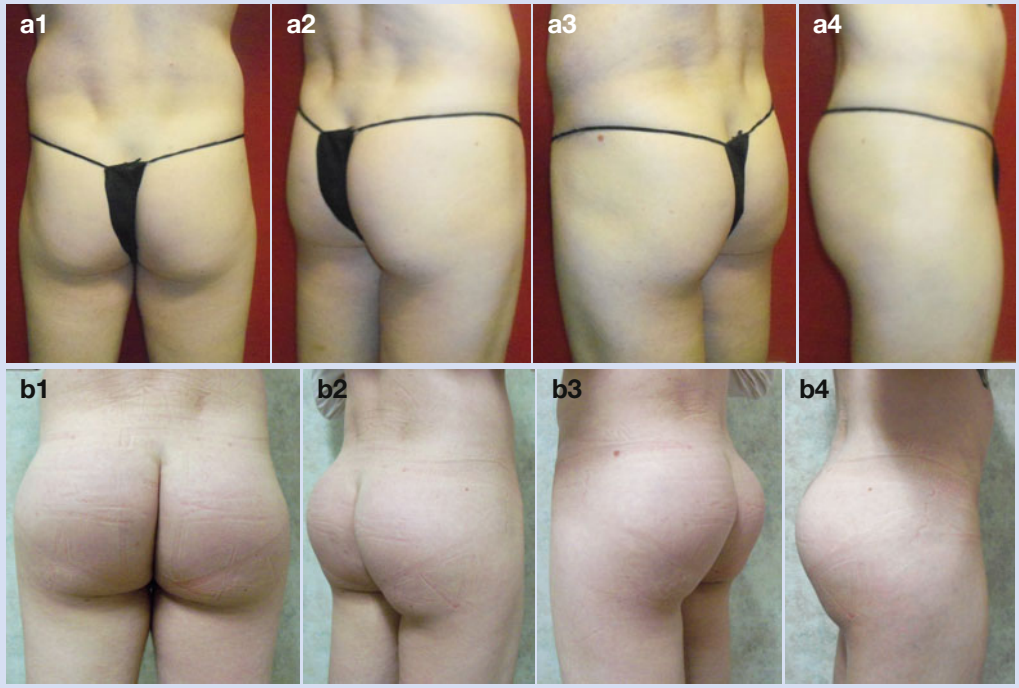


Fig. 6.54 (**a**) Preoperative. (**b**) Postoperative

Case 12 (Fig. 6.55)
A 30-year-old female underwent buttock augmentation with style 3, size 8 implants along with liposuction of the back and hips. The patient is seen preoperative and 1 month postoperative.

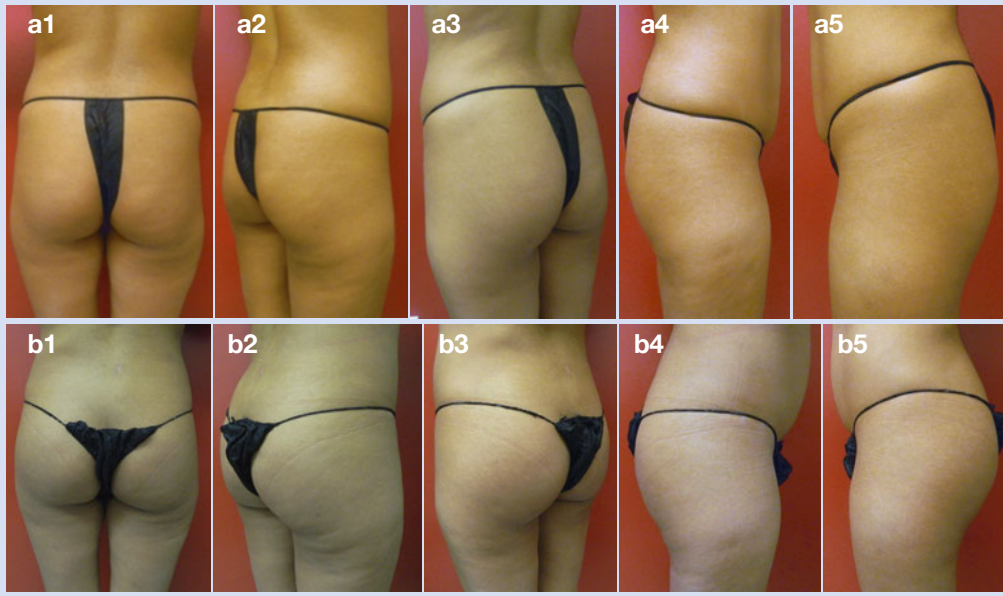


Fig. 6.55 (**a**) Preoperative. (**b**) Postoperative

Case 13 (Fig. 6.56)
A 27-year-old female underwent buttock augmentation with style 3, size 7 implants with minor liposuction of the waist (300-mL fat aspirated). The patient is seen preoperative and 1 month postoperative.

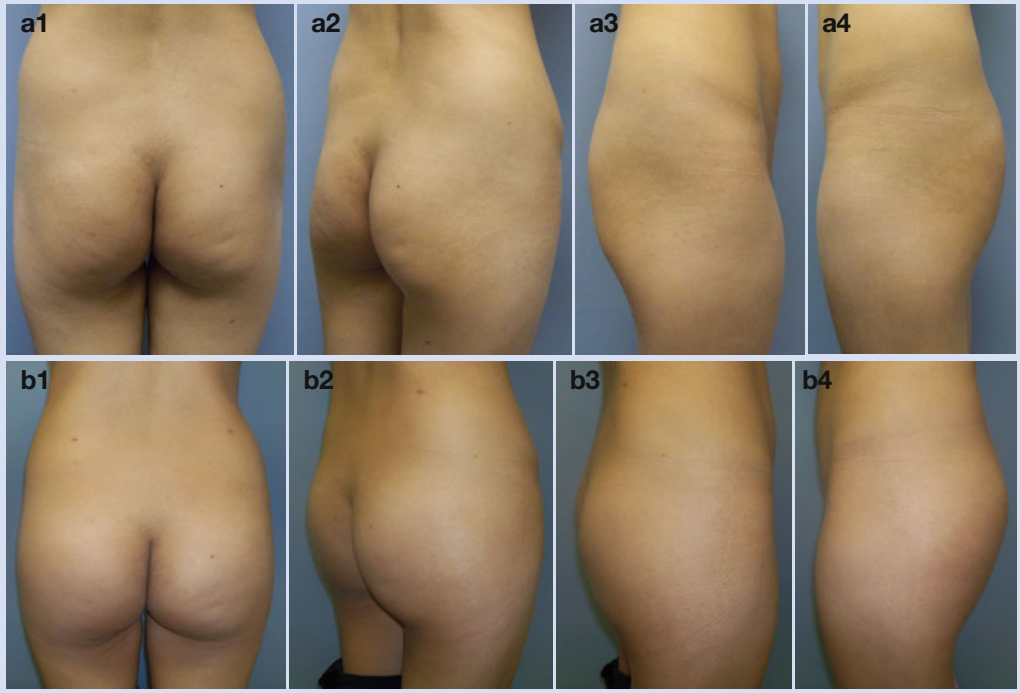


Fig. 6.56 (**a**) Preoperative. (**b**) Postoperative

Case 14 (Fig. 6.57)
A 49-year-old male underwent buttock augmentation with style 3, size 7 implants to achieve greater projection and roundness to the buttocks. The patient is seen preoperative and 1 month postoperative.

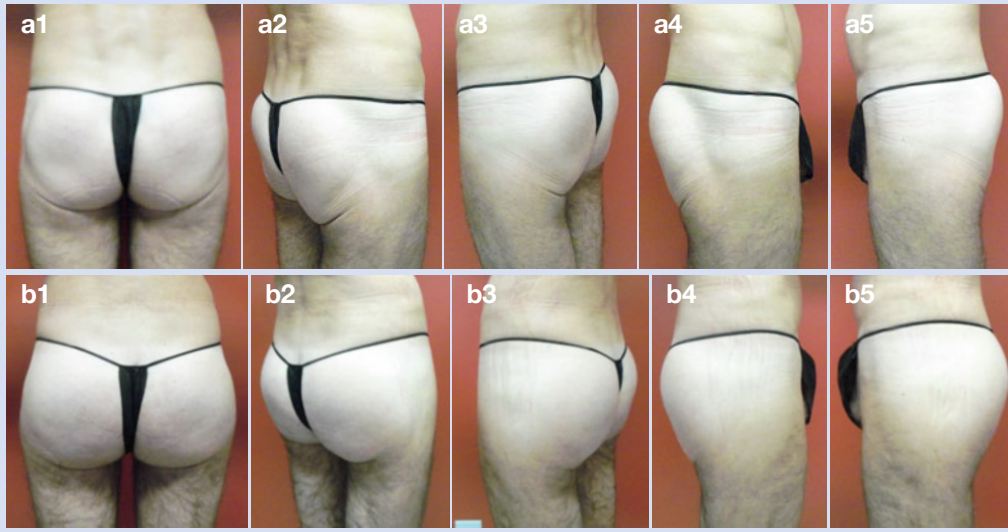


Fig. 6.57 (**a**) Preoperative. (**b**) Postoperative

Case 15 (Fig. 6.58)
A 29-year-old female underwent buttock augmentation with style 3, size 8 implant along with liposuction of the hips/flanks and fat grafting to the lateral thigh and butt (100 mL to the left side and 150 mL to the right side). The patient is seen preoperative and 6 months postoperative.

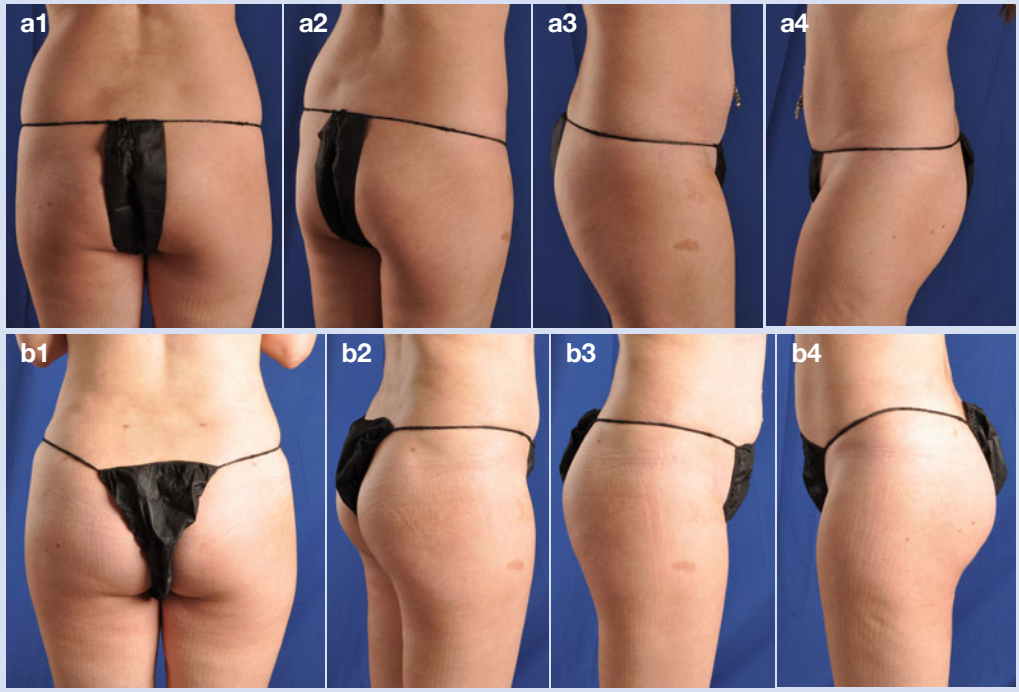


Fig. 6.58 (**a**) Preoperative. (**b**) Postoperative

Case 16 (Fig. 6.59)
A 24-year-old female underwent buttock augmentation with style 3, size 7 implants. The patient is seen preoperative and 5 months postoperative.

Fig. 6.59 (**a**) Preoperative. (**b**) Postoperative

Case 17 (Fig. 6.60)
A 69-year-old female underwent buttock augmentation to help correct sagging skin and significant cellulite. She had style 3, size 3 implants placed and is noted to have less dimpling of the skin and a much smoother contour. Although not a perfect solution, patients with sagging skin may benefit from augmentation to fill out the region. The patient is seen preoperative and 4 months postoperative.

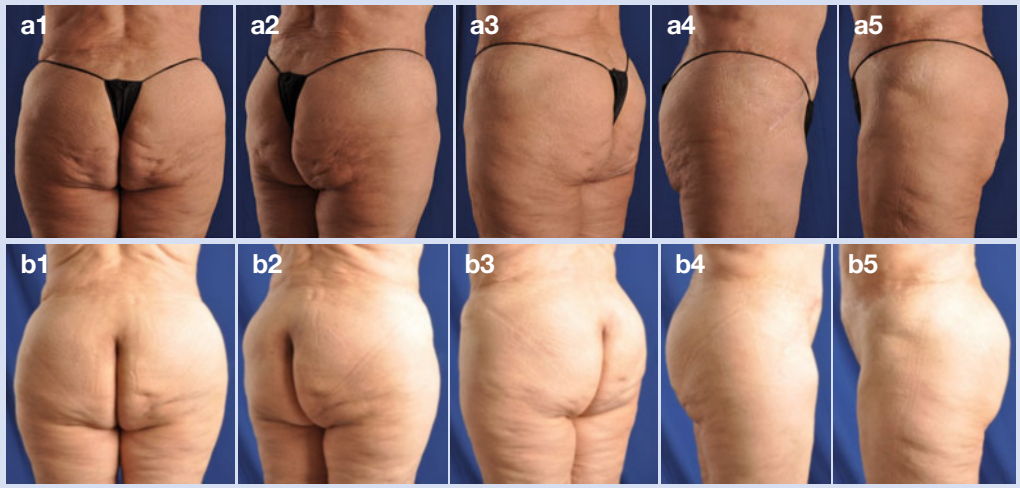


Fig. 6.60 (**a**) Preoperative. (**b**) Postoperative

Case 18 (Fig. 6.61)
A 22-year-old female underwent liposuction of the hips (300 mL of fat) along with buttock augmentation with style 3, size 2 implants. The patient is seen preoperative and 1.5 months postoperative.

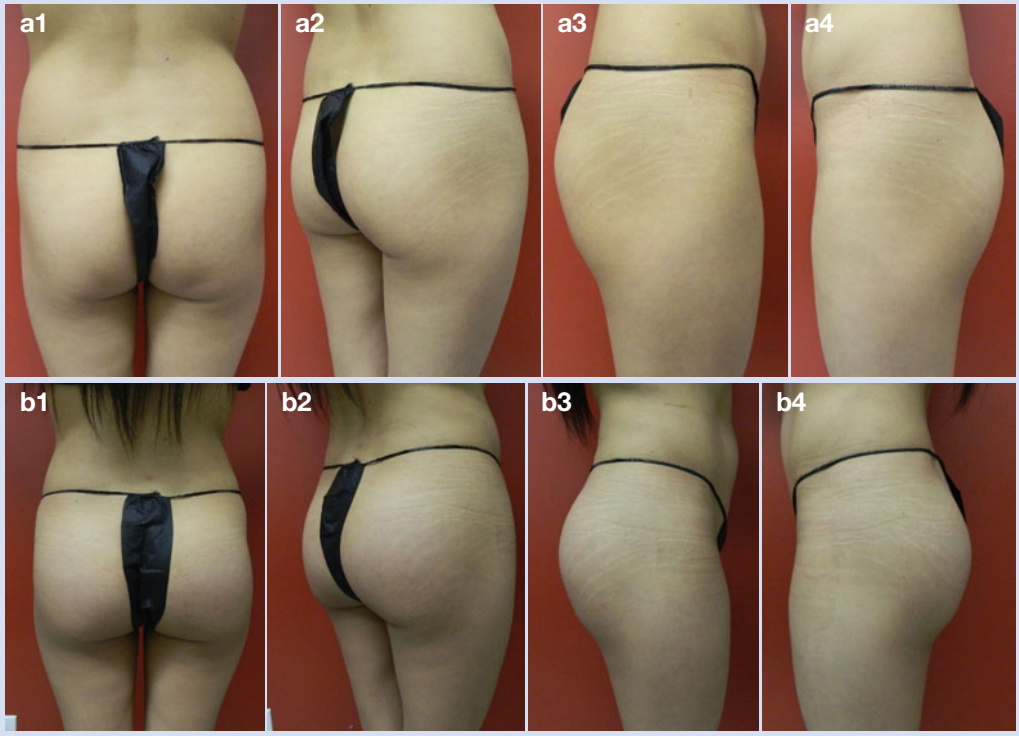


Fig. 6.61 (**a**) Preoperative. (**b**) Postoperative

Case 19 (Fig. 6.62)
A 28-year-old female presented for consultation after having lost 100 lb with bariatric surgery. She had significant skin laxity, sagging of the buttocks, and severely depressed trochanteric depressions. She wanted to improve the contour of her buttocks and did not want to undergo a buttock lift with significant scarring. She elected to proceed with buttock augmentation with style 3, size 3 implants. She is seen preoperative and 5 months postoperative.

Fig. 6.62 (**a**) Preoperative. (**b**) Marking. (**c**) Postoperative

Case 20 (Fig. 6.63)
A 28-year-old gay male underwent buttock augmentation to have a rounder bottom. He had style 3, size 7 implants placed. The patient is seen preoperative and 3 months postoperative.

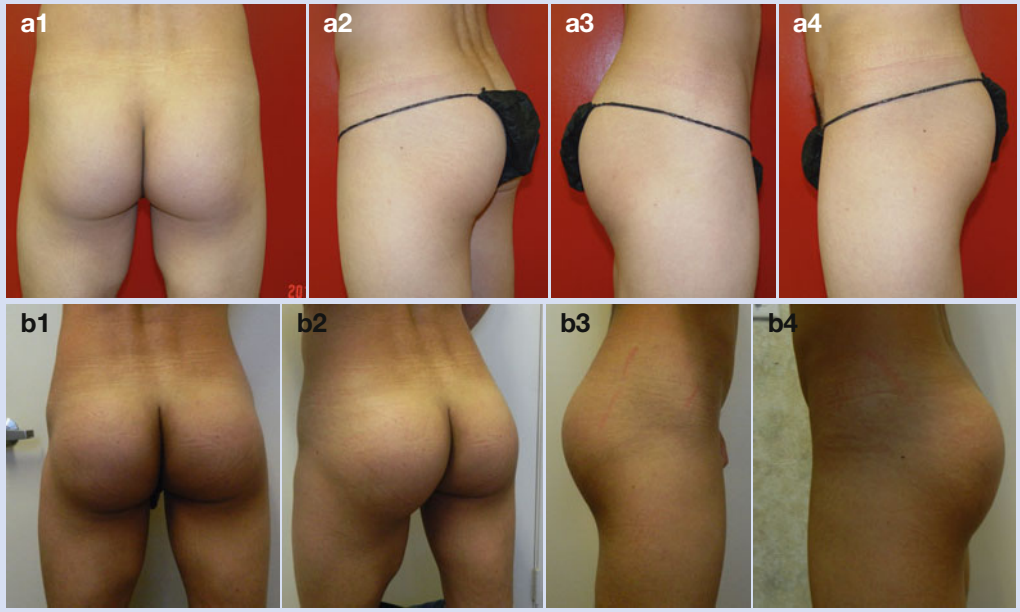


Fig. 6.63 (**a**) Preoperative. (**b**) Postoperative

Case 21 (Fig. 6.64)
A 23-year-old female underwent buttock augmentation with style 3, size 3 implants. The patient is seen preoperative and 1 month postoperative.

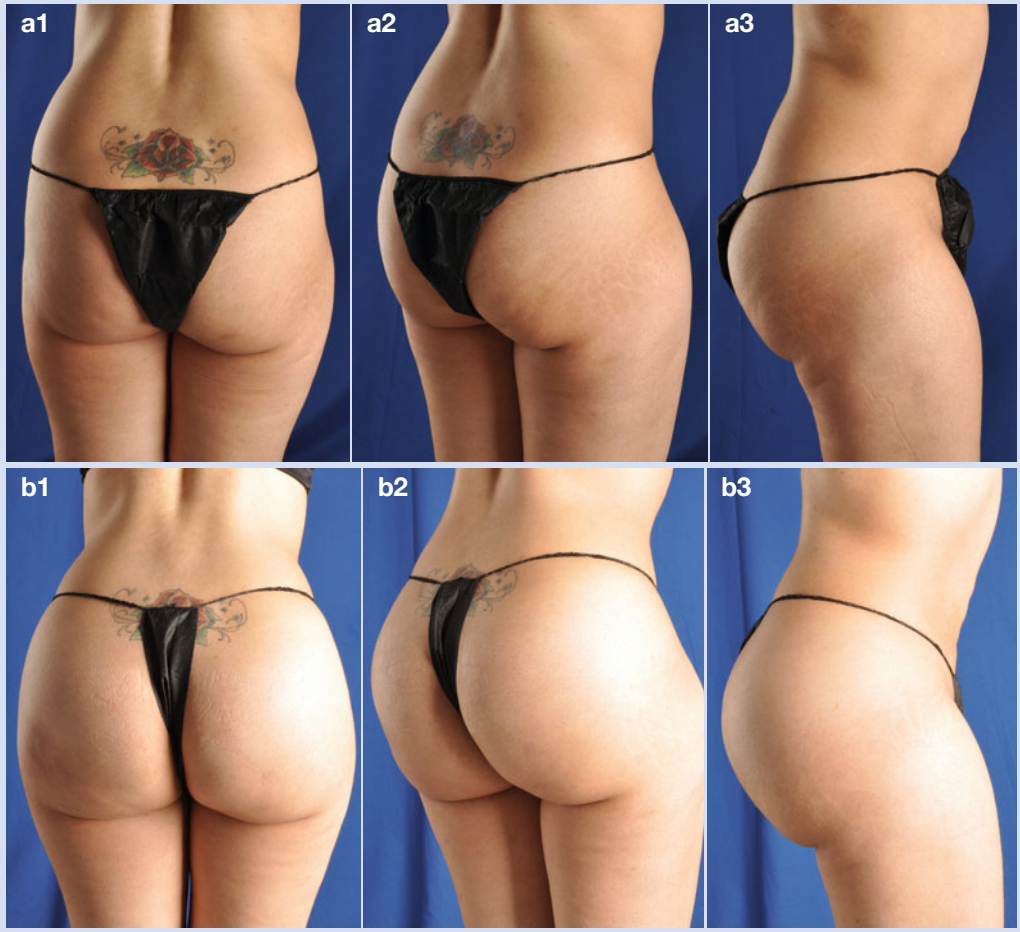


Fig. 6.64 (**a**) Preoperative. (**b**) Postoperative

Case 22 (Fig. 6.65)
A 52-year-old male underwent buttock augmentation with style 3, size 7 implants. He is seen preoperative and 3 months postoperative.

Fig. 6.65 (**a**) Preoperative. (**b**) Postoperative

Case 23 (Fig. 6.66)
A 31-year-old female underwent buttock augmentation with style 3, size 3 (379 mL) implant. One year later she was unhappy with the size of her butt and elected to exchange the implants for larger implants, moving to a style 3, size 9 implant (485 mL), giving her a slightly wider and more projected look. With any case of patients wishing to achieve a greater augmentation, we always have a discussion about staged procedures. It is unlikely that the patient would have tolerated a size 9 implant at the initial augmentation. Staged operations can be performed at an interval of 3–6 months at minimum, allowing sufficient stretch of the pocket to accommodate a larger implant.

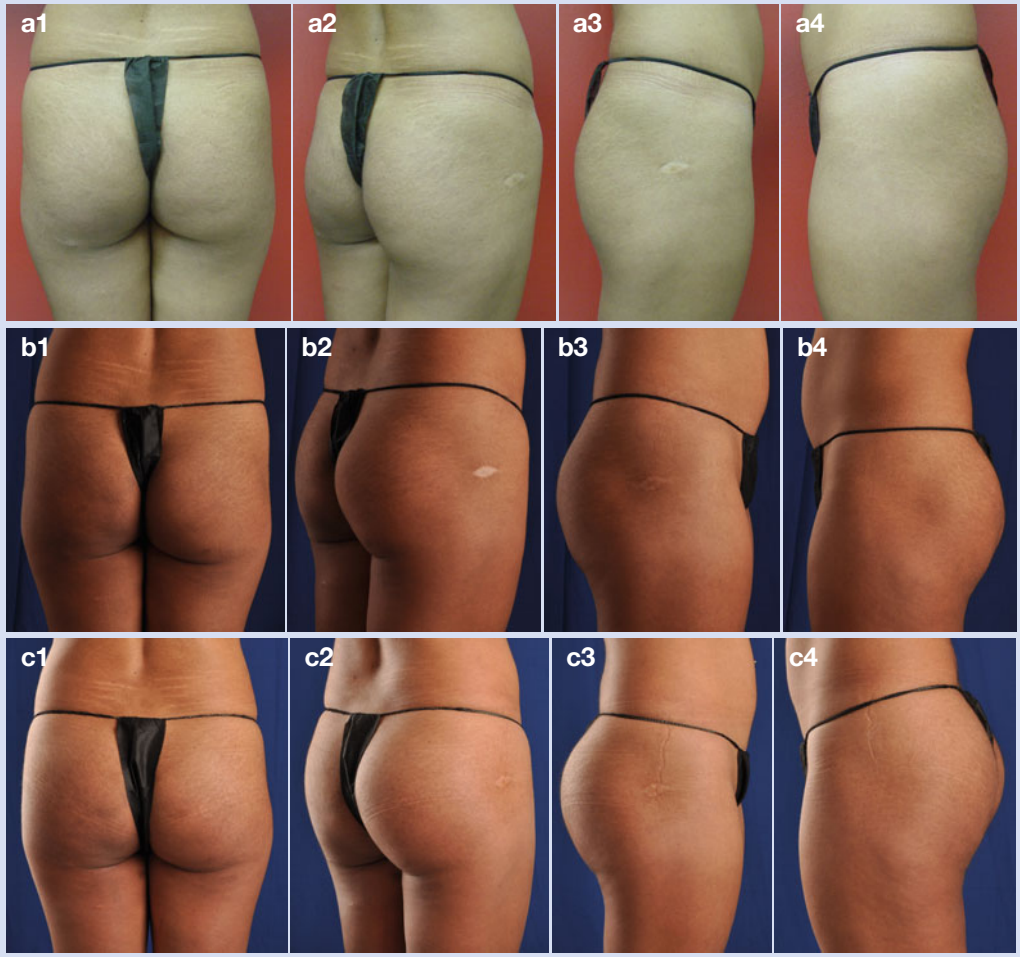


Fig. 6.66 (**a**) Preoperative. (**b**) One year postoperative following first buttock augmentation. (**c**) Postoperative following exchange of implants to larger size

Case 24 (Fig. 6.67)
A 59-year-old male underwent buttock augmentation with style 3, size 3 (379 mL) implants as he felt there was excessive laxity in his buttock region and he had "lost his butt." The patient is seen preoperative and 2 months postoperative.

Fig. 6.67 (**a**) Preoperative. (**b**) Postoperative

Case 25 (Fig. 6.68)

A 30-year-old male underwent buttock augmentation with style 3, size 7 implants as he felt that he had no buttock projection. He is seen preoperative and 1 year postoperative.

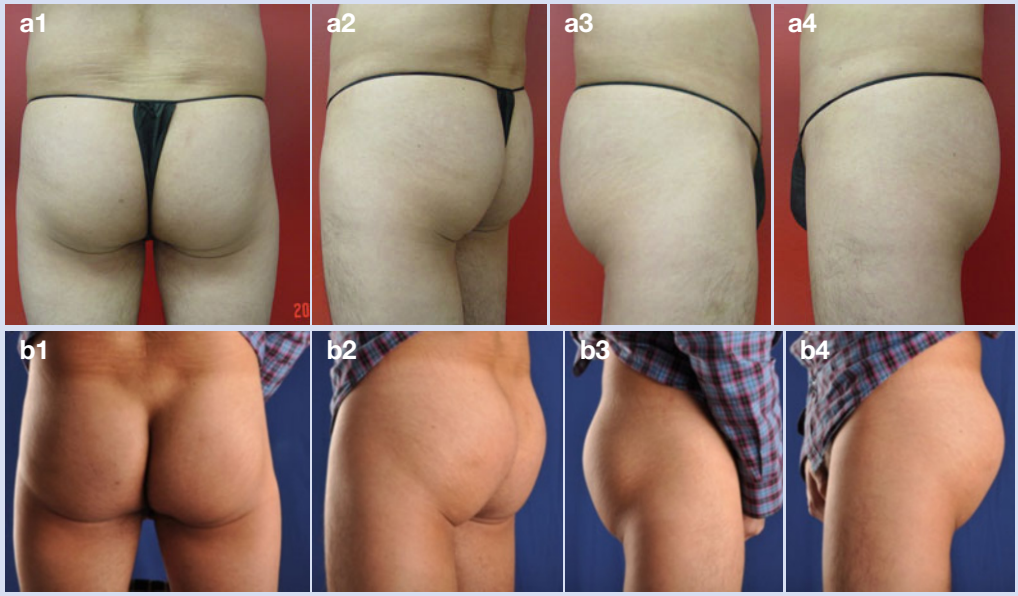


Fig. 6.68 (**a**) Preoperative. (**b**) Postoperative

Conclusions

Buttock augmentation has evolved dramatically from its infancy in the 1970s. Currently the surgeon has several positions to choose from for implant placement: subcutaneous (not recommended), submuscular, intramuscular, intermuscular, and subfascial. The intermuscular position is our preferred technique due to the ample space possible for augmentation, significant implant coverage afforded, and the decreased risk of sciatic injury. While there are various possibilities for incision placement, the intergluteal fold incision affords the best hidden and aesthetically pleasing scar. When considering buttock augmentation, the patient has the option of implant augmentation or augmentation with fat grafting, and the patient should be counseled on the risks and benefits of one procedure over another. Lastly, surgeons should always keep in mind adjunctive procedures to help accentuate the augmentation procedure performed for the patient.

References

1. ASAPS. 2006 Cosmetic Surgery National Data Bank Statistics. New York: ASAPS; 2007.
2. 2012 Plastic surgery statistics report. http://www.plasticsurgery.org/Documents/news-resources/statistics/2012-Plastic-Surgery-Statistics/full-plastic-surgery-statistics-report.pdf. Accessed 14 Sept 2013.
3. 2008 American Academy of Cosmetic Surgery Procedural Census. http://multivu.prnewswire.com/mnr/aacs/36867/docs/36867AACS2008ProceduralSurveyResults.pdf. Accessed 14 Sept 2013.
4. Singh D. Universal allure of the hourglass figure: an evolutionary theory of female physical attractiveness. Clin Plast Surg. 2006;33(3):359–70.
5. Lee EI, Roberts TL, Bruner TW. Ethnic considerations in buttock aesthetics. Semin Plast Surg. 2009;23(3):232–42.
6. Cardenas-Camarena L, Paillet JC. Combined gluteoplasty: liposuction and gluteal implants. Plast Reconstr Surg. 2007;119(3):1067–74.
7. Centeno RF. Gluteal aesthetic unit classification: a tool to improve outcomes in body contouring. Aesthetic Surg J. 2006;26(2):200–8.

8. Mendieta CG. Classification system for gluteal evaluation. Clin Plast Surg. 2006;33(3):333–46.
9. Bartels RJ, O'Malley JE, Douglas WM, Wilson RG. An unusual use of the Cronin breast prosthesis. Plast Reconstr Surg. 1969;44(5):500.
10. Cocke WM, Ricketson G. Gluteal augmentation. Plast Reconstr Surg. 1973;52(1):93.
11. Douglas WM, Bartels RJ, Baker JL. An experience in aesthetic buttocks augmentation. Clin Plast Surg. 1975;2(3):471.
12. Buchuk L. Gluteoplastia de aumento. Cir Plast Iberolatinoamericana. 1980;6(1):29.
13. Robles JM, Tagliaprietra JC, Grandi MA. Gluteoplastia de aumento: implantes submusculares. Cir Plast Iberolatinoamericana. 1984;10:4.
14. Gonzalez Ulloa M. Gluteoplasty: a ten year report. Aesthetic Plast Surg. 1991;15(1):85–91.
15. Vergara R, Amezcua H. Intramuscular gluteal implants: 15 years' experience. Aesthet Surg J. 2003;23(2):86–91.
16. Gonzalez Ulloa M. A review of the present status of the correction for sagging buttocks. In: Annals of the IV Congress of the International Society of Aesthetic Plastic Surgery, Mexico City, Apr 1977.
17. Chugay N. Modification of buttock augmentation. Am J Cosmet Surg. 1997;14(4):405–11.
18. Vergara R, Marcos M. Intramuscular gluteal implants. Aesthetic Plast Surg. 1996;20(3):259–62.
19. Bortoluzzi Daniel MJ, Maluf I. What is the durability of gluteal prostheses? Rev Bras Cir Plast. 2012;27(1):93–6.
20. Peren PA, Gomez JB, Guerrerosantos J, Salazar CA. Gluteus augmentation with fat grafting. Aesthetic Plast Surg. 2000;24(6):412–7.
21. de la Pena JA. Subfascial technique for gluteal augmentation. Aesthet Surg J. 2004;24(32):265–73.
22. Gonzalez R. Augmentation gluteoplasty: the XYZ method. Aesthetic Plast Surg. 2004;28(6):417–25.
23. Mendieta C. Intramuscular buttock implant augmentation. In: Presented at the annual meeting of the American Society of Plastic Surgery, Chicago, 27 Sept 2005.
24. Badin A, Vieira J. Endoscopically assisted buttocks augmentation. Aesthetic Plast Surg. 2007;31(6):651–6.
25. De la Pena JA, Rubio OV, Cano JP, Cedillo MC, Garces MT. History of gluteal augmentation. Clin Plast Surg. 2006;33(3):307–19.
26. Rocha R. Surgical anatomy of the gluteal region's subcutaneous screen and its use in plastic surgery. Aesthetic Plast Surg. 2001;25(2):140–4.
27. Gray H. Anatomy of the human body. Philadelphia: Lea & Febiger; 1918.
28. Pan WR, Taylor GI. The angiosomes of the thigh and buttock. Plast Reconstr Surg. 2009;123(1):79–86.
29. Clawson DK, Seddon HJ. The late consequences of sciatic nerve injury. J Bone Joint Surg. 1960;42(2):213–26.
30. Senderoff DM. Buttock augmentation using solid silicone implants. Aesthet Surg J. 2011;31(3):3200–327.
31. Mendietta CG. Gluteoplasty. Aesthetic Surg J. 2003;23(6):441–55.
32. Ford RD, Simpson WD. Massive extrication of traumatically ruptured buttock silicone prosthesis. Ann Plast Surg. 1992;29(1):86–8.
33. Alperovich M, Schreiber J, Singh NK. Infection after augmentation gluteoplasty in a pregnant patient. Aesthet Surg J. 2007;27(6):622–5.
34. Buchuk L. Complication with gluteal prosthesis. Plast Reconstr Surg. 1986;77(6):1012.
35. Chugay PN, Chugay NV. Buttock augmentation with implants and fat grafting: a comparative study. Am J Cosmet Surg. 2012;29(3):180–6.
36. Bruner TW, Roberts 3rd TL, Nguyen K. Complications of buttocks augmentation: diagnosis, management and prevention. Clin Plast Surg. 2006; 33(3):449–66.
37. Cardenas-Camarena L, Lacouture AM, Tobar-Losada A. Combined gluteoplasty: liposuction and lipoinjection. Plast Reconstr Surg. 1999;104(5): 1524–31.
38. Wang HD, Zheng JH, Deng CL, Liu QY, Yang SL. Fat embolism syndromes following liposuction. Aesthetic Plast Surg. 2008;32(5):731–6.
39. Mellor A, Soni N. Fat embolism. Anesthesia. 2001; 56(2):145–54.
40. Henson JT, Roberts CS, Giannoudis PV. Gluteal compartment syndrome. Acta Orthop Belg. 2009;75(2): 147–52.
41. Coleman SR. Long-term survival of fat transplants: controlled demonstration. Aesthetic Plast Surg. 1995;19(5):421–5.
42. Aiache AE. Gluteal re-contouring with combination treatments: implants, liposuction, and fat transfer. Clin Plast Surg. 2006;33(3):395–403.
43. Coleman SR. Structural fat grafting: more than a permanent filler. Plast Reconstr Surg. 2006;118(3 Suppl): 108S–20.
44. Coleman SR. Facial augmentation with structural fat grafting. Clin Plast Surg. 2006;33(4):567–77.
45. Niechajev I, Sevcuk O. Long term results of fat transplantation: clinical and histological studies. Plast Reconstr Surg. 1994;94(3):496–506.
46. Cardenas-Camarena L, Silva Gavarrete JF, Arenas-Quintana R. Gluteal contour improvement: different surgical alternatives. Aesthetic Plast Surg. 2011;35(6): 1117–25.
47. Pereira LH, Radwanski HN. Fat grafting of the buttocks and lower limbs. Aesthetic Plast Surg. 1996;20(5):409–16.
48. Harrison D, Selvaggi GJ. Gluteal augmentation surgery: indications and surgical management. Plast Reconstr Aesthet Surg. 2007;60(8):922–8.
49. Pedroza LV. Fat transplantation to the buttocks and legs for aesthetic enhancement or correction of deformities: long term results of large volumes of fat transplant. Dermatol Surg. 2000;26(12):1145–9.
50. Restrepo JC, Ahmed JA. Large volume lipoinjection for gluteal augmentation. Aesthetic Surg J. 2002; 22(1):33–8.
51. Murillo WL. Buttock augmentation: case studies of fat injection monitored by magnetic resonance imaging. Plast Reconstr Surg. 2004;114(6): 1606–14.
52. Har-Shai Y, Lindenbaum ES, Gamliel-Lazarovich A, Beach D, Hirshowitz B. An integrated approach for increasing the survival of autologous fat grafts in the treatment of contour defects. Plast Reconstr Surg. 1999;104(4):945–54.
53. Guerrerosantos J. Autologous fat grafting for body contouring. Clin Plast Surg. 1996;23(4):619–31.