

# Gluteal Augmentation Techniques: A Comprehensive Literature Review

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## Abstract

**Background:** Many studies of gluteal augmentation techniques have been published in recent decades, including case reports, retrospective and prospective case series, and multicenter survey reviews. However, to date, there has been no study of the overall complications or satisfaction rates associated with the broad spectrum of techniques.

**Objectives:** The authors performed a comprehensive literature review to determine outcomes and complications of gluteoplasty techniques, including patient satisfaction.

**Methods:** A search on PubMed/Medline was performed for clinical studies involving gluteal augmentation techniques. A priori criteria were used to review the resulting articles.

**Results:** Fifty-two studies, published from 1969 through 2015, were included – representing 7834 treated patients. Five gluteal augmentation techniques were identified from these studies: gluteal augmentation with implants ( $n = 4781$ ), autologous fat grafting ( $n = 2609$ ), local flaps ( $n = 369$ ), hyaluronic acid gel injection ( $n = 69$ ), and local tissue rearrangement ( $n = 6$ ). The overall complication rates of the most commonly utilized techniques were: 30.5% for gluteal augmentation with implants, 10.5% for autologous fat grafting, and 22% for local flaps. Patients' satisfaction was reported as consistently high for all the five techniques.

**Conclusions:** Implant-based gluteal augmentation is associated with high patients' satisfaction despite a high complication rate, while autologous fat grafting is associated with the lowest complication rate yet including serious major complications such as fat embolism. Local flaps and local tissue rearrangements are the ideal procedures in case of massive weight loss patients. A paucity of data is available for hyaluronic acid gel injections, which appear to be effective but temporary and expensive.

## Level of Evidence: 4



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The first description of gluteal augmentation was reported by Bartels et al in 1969 to correct buttock asymmetry by implanting a breast Cronin prosthesis.<sup>1,2</sup> Four years later it was described the first case of gluteal augmentation performed for aesthetic purposes.<sup>3</sup>

Since then, many surgical approaches to this procedure have been developed to meet the fast growing request of the patients. The American Society for Aesthetic Plastic Surgery has indeed featured that the number of operations performed in the United States has increased tremendously over the last decade, with a 58% increase in the number of buttock augmentation surgeries performed in 2013 and approximately 20,000 American patients undergoing this procedure in 2015.<sup>4-6</sup>

As “beautiful buttocks” are perceived as an important attribute of sexual attraction and beauty in every culture,<sup>7</sup> it has been recently emphasized that a correct surgical approach, including the selection of the appropriate techniques, should aim at fulfilling both, universally recognized ideals of attractiveness, and specific ethnically defined differences.<sup>8</sup> Universal aesthetic ideals of the female gluteal region, regardless of ethnicity, are defined by a ratio of the waist circumference at its narrowest to the thighs (“hips”) circumference at the level of the maximum prominence of the buttocks (waist-to-hip ratio) equal to 0.7.<sup>8-10</sup> Ethnic differences have been instead described by Roberts et al as related to buttock size, lateral buttock fullness, and lateral thigh fullness.<sup>10</sup>

So far, five buttock augmentation techniques have been comprehensively implemented: gluteal augmentation with implants, autologous fat grafting, local flaps, hyaluronic acid gel injection, and local tissue rearrangement.<sup>6</sup> According to the United States cosmetic surgery statistics, implant-based gluteoplasty and autologous fat grafting are the most commonly utilized techniques.<sup>4-6</sup>

However, despite the copious request and the growing number of publications on this hot topic, there is a paucity of data to guide treatment paradigms with no study of the overall complications or satisfaction rates associated with the broad spectrum of techniques. The aim of the present article is to review outcomes of the various gluteoplasty techniques, including associated complications.

## METHODS

To determine the efficacy and complications of gluteal augmentation techniques, we performed a literature review of studies on the surgical treatment of the gluteal region for cosmetic purposes. From December 2015 to January 2016, a review of the entire PubMed database was performed with the following search algorithm: ((gluteoplasty) OR (buttock augmentation) OR (gluteal augmentation)) AND ((etiology) OR (epidemiology) OR (classification) OR

(indications) OR (treatment)). There were no restrictions on time or language of publication. Additional articles were considered after reviewing references of the publications identified initially.

Articles were required to be of the following types: case study, case report, case series, clinical trial, open-label prospective study, or retrospective study. Also necessary for inclusion was the utilization of gluteoplasty as surgical therapy. Excluded from the analysis were literature reviews, articles in which gluteoplasty was not viewed from a surgical perspective, studies describing secondary intervention, treatment or analysis of previous complications, and publications in which it was impossible to determine the specific technique of gluteoplasty or with unclear presentation of outcomes and complications.

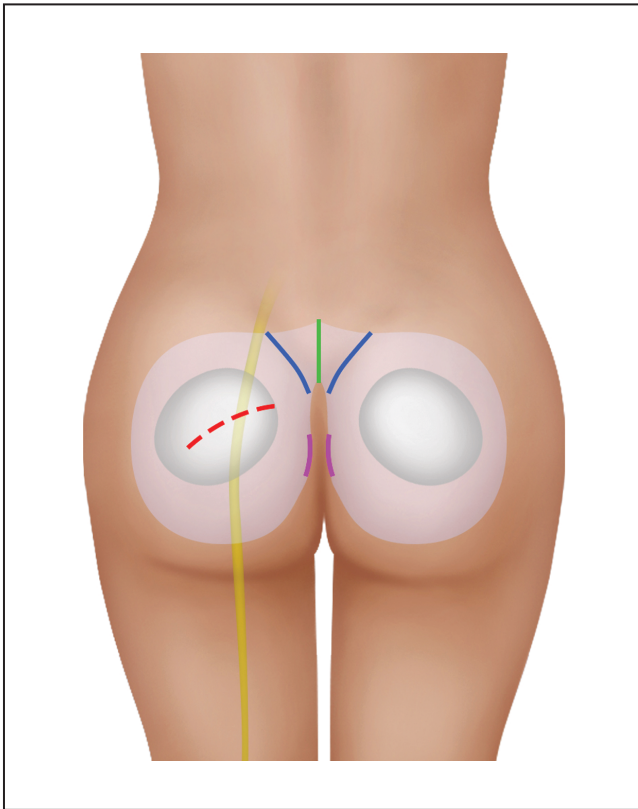
All publications were screened manually. Three investigators (C.M.O., M.T., and P.G.d.S.) independently reviewed and extracted data from the papers, according to the predetermined criteria.

The following information was documented and tabulated for each article: author name(s), year of publication, number of patients, age of patients, surgical technique, outcomes, and complications. All types of gluteoplasty were considered, including: gluteal augmentation with implants, autologous fat grafting, local flaps, hyaluronic acid gel injection, and local tissue rearrangement. Quality assessment of the studies included randomization, representativeness of study samples, baseline comparability of groups, credibility of data collection tools, attributability, and attrition rate.

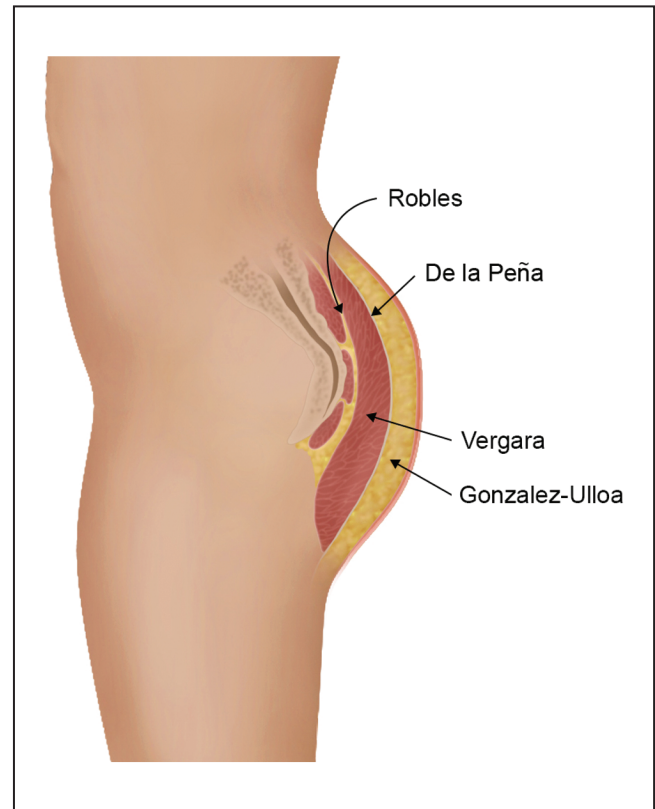
## RESULTS

We initially identified 152 full-text articles, 108 of which did not meet the inclusion criteria. Eight articles were added after reviewing references of the publications identified initially. Therefore, our analysis comprised 52 studies, which were published from 1969 through 2015 ([Appendix A](#), available as Supplementary Material). Ten were case reports, 30 retrospective studies, 10 prospective studies, and 2 multicenter survey reviews. Overall, 7834 treated patients were represented (age range, 17-72 years). The sex of the patients was not specified by all the authors. Although the vast majority of the patients for whom this information was provided were female, both sexes were represented. Details are listed in [Appendix A](#). Five techniques of gluteal augmentation were identified: gluteal augmentation with implants ( $n = 4781$ ),<sup>1,2,7,11-30</sup> autologous fat grafting ( $n = 2609$ ),<sup>21,31-47</sup> local flaps ( $n = 369$ ),<sup>48-56</sup> hyaluronic acid gel injection ( $n = 69$ ),<sup>57,58</sup> and local tissue rearrangement ( $n = 6$ ).<sup>59</sup>

Gluteal augmentation with implants ([Figures 1-2](#)) presented an overall complication rate equal to 30.5%.



**Figure 1.** Gluteal augmentation with implants: the area of dissection is marked (gray); one or two incisional accesses are placed in different locations: a single incision can be placed medially in the sacral area (green); two bilateral incisions can be placed in the para-sacral area (blue) or in the gluteal cleft (fuchsia).<sup>24,67</sup> Muscle spitting incisions are parallel to fibers (red).<sup>67</sup> Attention should be paid in order to avoid injuries of the sciatic nerve (yellow).



**Figure 2.** Gluteal augmentation with implants: insertion planes are defined in relation to the gluteus maximus muscle:<sup>30</sup> subcutaneous (according to Gonzalez-Ulloa),<sup>63</sup> subfascial (according to De la Peña),<sup>64</sup> intramuscular (according to Vergara),<sup>65</sup> and submuscular (according to Robles).<sup>66</sup>

The most common complication was wound dehiscence (8.1%), while implant specific complications were: implant revision (3.1%), implant removal (1.9%), implant palpability (1.7%), implant displacement including rotation (1%), and capsular contracture (0.7%). All of the complications observed are listed in [Table 1](#).

The overall complication rate in autologous fat grafting patients ([Figure 3](#)) was 10.5%, with seroma of the donor site reported as the most common complication (3.1%). Major complications included four cases of fat embolism, one of which led to death. All of autologous fat grafting complications are listed in [Table 2](#).

Notably, acute or chronic sciatic nerve symptoms occurred in 0.3% of patients treated with gluteal augmentation with implants, while one case of bilateral sciatic nerve axonotmesis was reported among patients treated with autologous fat grafting.

Gluteal augmentation with local flaps ([Figure 4](#)) included the following procedures: autoprosthesis buttock augmentation during lower body lifts (dermal fat

flaps),<sup>48,52,53,55</sup> bilateral lumbar hip dermal fat rotation flaps,<sup>49</sup> superior gluteal artery perforator flaps,<sup>50</sup> split gluteal muscle flaps,<sup>54</sup> and island fat flaps.<sup>56</sup> These techniques were performed in association with buttocks or body lift and described as particularly appropriate after massive weight loss.<sup>55</sup> The local flaps overall complication rate was equal to 22%; the most common complication was wound dehiscence (7.6%). Complications are listed in [Table 3](#).

All of the 6 patients treated with local tissue rearrangement, namely purse-string gluteoplasty, presented an uneventful postoperative evolution, with contour, shape, and projection of the buttocks improved at 6 month follow-up.<sup>59</sup>

Hyaluronic acid gel injections were reported only in two studies on 69 patients. The overall complication rate was equal to 39.1%. None of the complications assessed by the investigators as related to treatment was serious.<sup>58</sup> Details are reported in [Table 4](#).

The diversity of methods used to evaluate satisfaction outcomes prevented a quantitative analysis. However, satisfaction of both surgeons and patients was reported

**Table 1.** Complications Observed After Gluteal Augmentation With Implants

Complication	No. of instances (%)
Wound dehiscence	389 (8.1)
Seroma	212 (4.4)
Infection	153 (3.2)
Implant revision	150 (3.1)
Prolonged acute pain	113 (2.4)
Implant removal	93 (1.9)
Implant palpability	82 (1.7)
Asymmetry	63 (1.3)
Implant displacement including rotation	49 (1)
Wide scars	47 (1)
Hematoma	40 (0.8)
Capsular contracture	32 (0.7)
Chronic pain	28 (0.6)
Sciatic nerve symptoms	14 (0.3)
Dissatisfaction with the final volume	13 (0.3)
Bruising	4 (0.1)
Implant rupture	3 (0.1)
Neuroapraxia	1 (0.02)
<b>Total number of complications</b>	<b>1486 (30.5)</b>

as consistently high by all authors who investigated this aspect. Details are reported in [Appendix A](#).

## DISCUSSION

Gluteoplasty has recently gained a tremendous increase in popularity, and consequently has drawn greater scrutiny.<sup>4-6</sup> Many plastic surgeons are reluctant to perform this operation, emphasizing the high complication rates associated with gluteal augmentation with implants and the fatal risks associated with fat grafting, namely fat embolism. Although recent reviews have been published,<sup>60,61</sup> a comprehensive literature review including all the possible techniques has not.

With our inclusion criteria, we selected 52 articles, representing 7834 patients treated with gluteal augmentation. We primarily focused on giving a classification of techniques and standardized practice guidelines. We considered all English and non-English literature, and determined overall complication and satisfaction rates across the spectrum of gluteoplasty techniques.

A limitation of our investigation is the high heterogeneity of the study populations. Selection bias and lack

of standardized outcome measures prevented a proper meta-analysis. Although this review does not constitute a meta-analysis, we assessed the literature critically and aimed to identify high-quality studies. Many technique-related studies demonstrating favorable results may be biased by authors who wish to promote their preferred techniques.

## Gluteal Augmentation with Implants

According to the results of this comprehensive review, gluteal augmentation with implants ([Figures 1-2](#)) is the most used technique, with 4781 cases described in the literature. This technique allows reshaping of the medial two thirds of the gluteal region. Moderate ptosis and asymmetries not involving the lateral buttocks represent the ideal indications.<sup>60</sup>

As it does not allow for the reshaping of the lateral third of the buttocks, gluteal augmentation with implants is less indicated than autologous fat grafting to reach the ideal combination of universal (waist-to-hip ratio of 0.7) and ethnic specific (buttock size, lateral buttock fullness, and lateral thigh fullness) female beauty ideals.<sup>8-10</sup> However, according to Lee et al, an exception can be identified with regards to the Asian population which very rarely desire lateral buttock fullness, wishing simply to restore the aesthetic back curvature.<sup>7,8,62</sup> Excellent cosmetic outcomes along with high patient satisfaction were indeed shown by Park and Whang among 125 Asian female patients undergoing intramuscular gluteal augmentation with oval-shaped smooth surface silicone implants.<sup>7,8</sup> However, also in this case, a combination of implant placement and liposuction of lumbar and trochanteric areas should always be considered as an ideal strategy.<sup>7,8</sup>

Many procedural variations have been described with regards to dissection plane for implant positioning, defined in relation to the gluteus maximus muscle:<sup>30</sup> subcutaneous (according to Gonzalez-Ulloa),<sup>63</sup> subfascial (according to De la Peña),<sup>64</sup> intramuscular (according to Vergara),<sup>65</sup> and submuscular (according to Robles).<sup>66</sup> A different number of incisional accesses (one or two) are placed in different locations: a single incision within the sacral area or the gluteal cleft or two separated incisions in each parasacral area or within the gluteal cleft.<sup>67</sup> On this regard, a multi-center survey review of 2226 patients undergoing buttock augmentation with silicone implants analyzed the technical preferences among targeted members of the American Society of Plastic Surgeons.<sup>24</sup> However, as the investigation collected anonymous data, it is in our opinion impossible to attribute patients to a specific surgeon, including Senderoff, de la Peña, and Mendieta, who are listed as co-authors, and it is never stated that the authors included their own patients in the analysis. Instead, according to the methods section of the article, their role was to examine data provided by other surgeons. This study reported that 68.4% of surgeons favored the intramuscular plane of

**Table 2.** Complications Observed After Autologous Fat Grafting

Complication	No. of instances (%)
Seroma	81 (3.1)
Hyperemia/erythema	41 (1.6)
Pain	31 (1.2)
Reoperation	23 (0.9)
Liponecrosis	19 (0.7)
Major/minor irregularities	18 (0.7)
Transient sacral numbness	16 (0.6)
Cellulitis	13 (0.5)
Asymmetry	10 (0.4)
Infection	7 (0.3)
Fat embolism	4 (0.2)
Skin deformities	2 (0.1)
Symptomatic hypovolemia	2 (0.1)
Hematoma	1 (0.04)
Septic shock	1 (0.04)
Death (fat embolism-related)	1 (0.04)
Hyperpigmentation	1 (0.04)
Unilateral aseptic abscess	1 (0.04)
Bilateral sciatic nerve axonotmesis	1 (0.04)
Recurrent postoperative swelling	1 (0.04)
<b>Total number of complications</b>	<b>274 (10.5)</b>

dissection over the subfascial plane, while no preference was observed between a single midline intergluteal incision and two parallel incisions within the gluteal cleft.<sup>6,24</sup>

These different surgical approaches have been associated with different possible complications. Almost all the authors that preferred the subfascial or intramuscular planes justified their choice as an attempt to reduce implant related complications.<sup>24</sup> These two planes present the further advantage of protecting the sciatic nerve from possible injuries which may especially occur when choosing the submuscular plan of insertion. In this case it is recommended to prepare the implant pocket in the superior part of the gluteal region.<sup>67</sup> Attention should however always be paid in order to avoid sciatic nerve injuries, which in our review involved comprehensively 0.3% of the patients.

Seroma formation was also a relevant complication, accounting for 4.4% of the cases. This can also be specifically correlated with the use of implants, and is mainly associated with textured prosthesis.<sup>60</sup>

The overall complication rate equal to 30.5% observed in this review was lower than that observed in the above mentioned survey among internationally recognized high qualified surgeons (38.1%),<sup>24</sup> suggesting that single surgeons' /institutions' experiences may evaluate more favorably their outcomes.

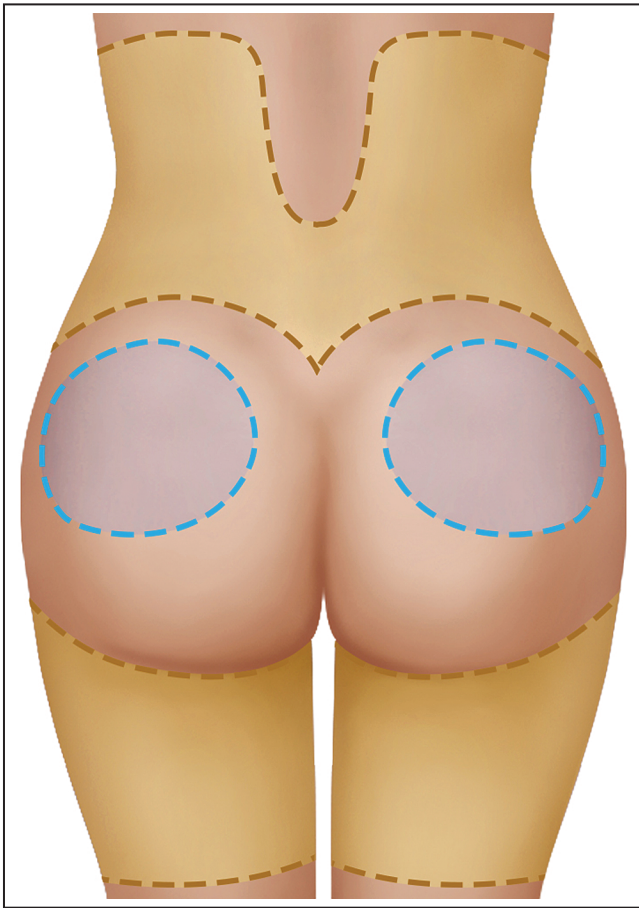
Finally, despite the high rate of complications, gluteal augmentation with implants was also associated with high satisfaction of patients and surgeons by the authors who included this aspect in their investigations, which also reported improved body image and confidence.<sup>7,12-15,17,19-21,23-28</sup>

## Autologous Fat Grafting

Autologous fat grafting is associated with the lowest rate of complications (10.5%) and presents the specific advantage of allowing reshaping the lateral third of the buttocks. It is ideal to correct finite asymmetries and volume deficiencies.<sup>60</sup> Moreover, it can be combined with liposuction of waist and lower back to create the universal ideal proportions of the female torso and meet the specific ethnic ideals of beautiful buttocks in one operation.<sup>10</sup> Thus, to this end, Roberts et al endorse using autologous fat grafting to augment not only the medial two-thirds of the buttocks, but also the lateral buttocks and the lateral thighs.<sup>8,10</sup>

A standardized technique of combining liposuction of lumbosacral, subgluteal, and trochanteric areas with lipoinjection in the upper middle buttock to improve the gluteal contour together with projection of the gluteus was firstly described by Cárdenas-Camarena et al in 1999 (Figure 3).<sup>31</sup> With this technique, Cárdenas-Camarena and colleagues obtained favorable outcomes, with more than 90% improvement according to patient and surgeon evaluations. The authors emphasized that fat excess in the lumbosacral region is one of the basic factors that must be corrected to obtain adequate gluteal shape, while contouring of the subgluteal and trochanteric regions is often but not always required.

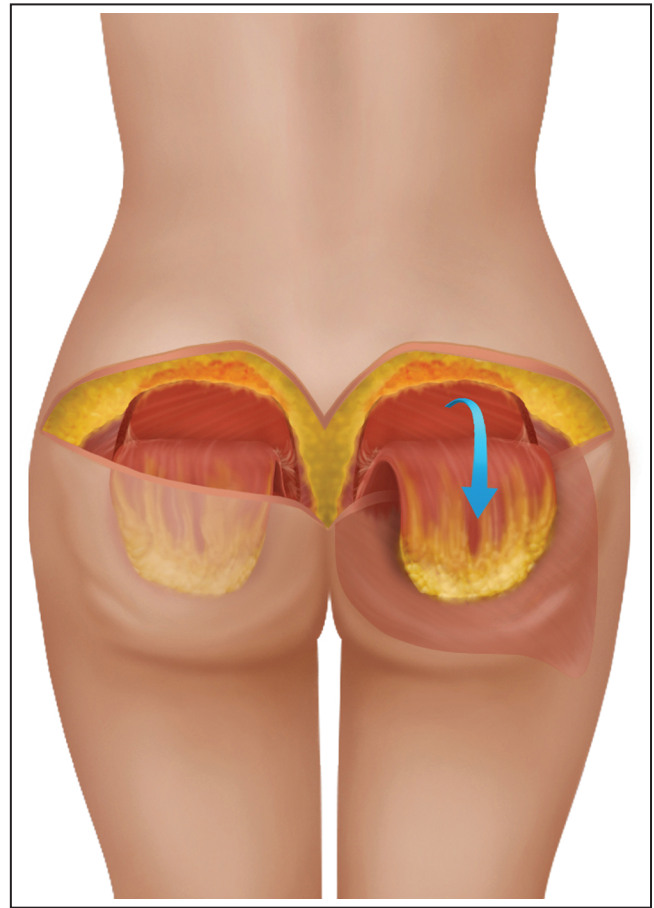
However, it was observed that gluteal augmentation with fat grafting should be performed by high specialized board certified plastic surgeons only.<sup>60</sup> A deep knowledge of the topography of the gluteal region and the familiarity with the technique are essential in order to safely reach a pleasant result.<sup>60</sup> It is especially relevant being able to avoid serious complications such as fat embolism, which was reported to occur in 0.2% of the cases included in our analysis, one of which led to death.<sup>47</sup> Secondary deaths from gluteal lipoinjection procedures were extensively analyzed through a survey of all members of the Mexican Association of Reconstructive, Plastic and Aesthetic Surgery, and through an analysis of deaths and autopsies in Colombia.<sup>68</sup> This research is here presented to analyze this complication and provide recommendations based on the current literature. However, the article did not meet our inclusion criteria, because it is an investigation which retrospectively identified solely patients



**Figure 3.** Combined gluteoplasty according to Cárdenas-Camarena<sup>31</sup>: areas of liposuction (yellow) and lipoinjection (blue).

affected by one complication, namely fat embolism deaths, without providing any information on the global number of patients undergoing gluteoplasty and on the other complications occurred. A total of 413 Mexican plastic surgeons reported 64 deaths related to liposuction, with 13 deaths caused by gluteal lipoinjection over a period of 15 years, while in Colombia nine deaths were documented over a period of 10 years. In this study, the authors found that intramuscular gluteal lipoinjection is associated with mortality caused by gluteal blood vessel damage which allows macroscopic and microscopic fat embolism; therefore, they recommended performing buttocks lipoinjection very carefully, avoiding injections into deep muscle planes. When the patient's subcutaneous tissue lacks width and it would be necessary to inject fat mainly into the muscles, it should be preferred to perform gluteal silicone implantation into the muscular plane and then complement the result with fat injection in the subcutaneous plane.<sup>69</sup>

Other complications include seroma of the donor site (3.1%), hyperemia/erythema (1.6%), liponecrosis (0.7%), major/minor irregularities (0.7%), cellulitis (0.5%), and



**Figure 4.** Split gluteal muscle flap for autoprosthesis buttock augmentation, according to Sozer.<sup>54</sup>

asymmetry (0.4%), which led to reoperation for unpleasing result in 0.9% of cases. Unpredictability of volume maintenance is also a concern related to this procedure, yet a study by Roberts et al on 556 patients reported a long-term fat graft survival varying approximately between 50% and 75%.<sup>33</sup>

However, despite all the issues, autologous fat grafting appears to be an extremely promising technique for gluteal augmentation, as confirmed by a recent research on 106 consecutive cases which emphasized the advantages of this procedure, described as simple and inexpensive, with minimal morbidity and excellent results in terms of patients' satisfaction (97.1%).<sup>8,46</sup>

Finally, an interesting alternative approach was described by Raposo do Amaral and colleagues as particularly appropriate in cases of patients undergoing concomitant abdominoplasty.<sup>36</sup> With their technique, two triangular, full-thickness dermal-fat autografts are harvested from the lower abdomen, deepithelialized, tubed, and introduced into the gluteal region through an intergluteal incision. Both patients treated by the authors achieved good buttock projection and contouring at 6 months postoperatively.

**Table 3.** Complications Observed After Gluteal Augmentation With Local Flaps

Complication	No. of instances (%)
Wound dehiscence	28 (7.6)
Delayed wound healing	23 (6.2)
Seroma	10 (2.7)
Skin necrosis	5 (1.4)
Reoperation	5 (1.4)
Liponecrosis	4 (1.1)
Suture extrusion	3 (0.8)
Infection	1 (0.3)
Hematoma	1 (0.3)
Pulmonary embolism	1 (0.3)
<b>Total number of complications</b>	<b>81 (22)</b>

## Local Flaps and Local Tissue Rearrangement

Local flaps for gluteal augmentation are described as a valid and successful tool in case of massive weight loss, with a complication rate (22%) similar to that recently reported for body contouring.<sup>70</sup> This approach can indeed be considered as a part of body contouring surgery, which is emerging as a subspecialty of plastic surgery, greatly influenced by the increased prevalence of successful bariatric surgery procedures over the past two decades resulting in a variety of body contour deformities not commonly seen by plastic surgeons in the past.<sup>70</sup>

The spectrum of procedures is thus ideally associated with body and buttock lift and includes many options, such as: autoprosthesis buttock augmentation during lower body lift (dermal fat flaps),<sup>48,52,53,55</sup> bilateral lumbar hip dermal fat rotation flaps,<sup>49</sup> superior gluteal artery perforator flaps,<sup>50</sup> split gluteal muscle flaps,<sup>54</sup> and island fat flaps,<sup>56</sup> which were comprehensively performed in 369 patients, mainly retrospectively studied.

Among the several flaps described to provide autologous augmentation to the gluteal area, an innovative and effective procedure was recently described by Sozer et al,<sup>54</sup> as a modification of a previously published technique to augment the buttocks during lower body lift (dermal fat flap). In the last 50 patients of a series of 200, they incorporated a split section of gluteus maximus muscle on a dermal fat flap randomly based and relying on the numerous gluteal perforators (Figure 4). In comparison to dermal fat flap alone, the incorporation of the split gluteus maximus muscle facilitated the rotation of the flap caudally and increased the vascular supply to

**Table 4.** Complications Observed After Hyaluronic Acid Gel Injection

Complication	No. of instances (%)
Swelling	5 (7.2)
Pruritus	5 (7.2)
Injection-site pain	4 (5.8)
Hematoma	4 (5.8)
Devise dislocation	3 (4.3)
Implant-site pain	3 (4.3)
Serum C-reactive protein elevation	2 (2.9)
Pyrexia (1 day)	1 (1.4)
<b>Total number of complications</b>	<b>27 (39.1)</b>

the flap, resulting in substantial decrease of fatty necrosis and maximum projection of the buttock at its midportion.

Finally, local tissue rearrangement includes the purse-string gluteoplasty described by Hunstad and Repta<sup>59</sup> as a way to treat gluteal atrophy and ptosis resulting with aging and weight loss. With this technique combined with buttock lift, the authors shaped and molded the central buttocks tissue achieving excellent aesthetic results in all of the 6 patients treated, which also experienced an uneventful postoperative course.

## Hyaluronic Acid Gel Injections

The use of hyaluronic acid gel injections for gluteal augmentation was investigated by two prospective studies, one of which was multicenter.<sup>57,58</sup> Their outcomes show that this is a safe and effective treatment for temporary aesthetic augmentation of the buttocks, yet limited by the cost of the injectable in relation to the huge quantity required.

Camenish et al treated eight subjects with a mean of 163 mL of nonanimal stabilized hyaluronic acid gel per buttock.<sup>57</sup> They reported 56%, 36%, and 24% of gel remaining in the buttocks, after 6, 12, and 24 months, respectively, located primarily in the subcutaneous fat. The treatment was well tolerated, with high subjects' and investigators' perceptions of aesthetic augmentation of the buttocks, even if only small volumes of the gel remained.

Finally, De Meyere et al, within a noncomparative multicenter study, treated 61 patients injecting hyaluronic acid gel at a maximum volume of 400 mL per subject during one or two treatment visits.<sup>58</sup> They observed that, although the substance degrades over time, a good proportion of the subjects still rated their buttocks as improved (40%) and expressed satisfaction (33%) 24 months after treatment.

## CONCLUSIONS

Five options are currently available to perform gluteal augmentation, all of which were associated with high patients' and surgeons' satisfaction. However, this review found a high rate of complications in case of implant-based gluteal augmentation (30.5%) and the risk of a serious complication such as fat embolism for fat grafting. It is therefore recommended that these procedures are handled by high qualified board certified plastic surgeons in order to ensure efficacy and safety. Other procedures, such as local flaps and local tissue rearrangements are indicated in case of massive weight loss, while more research is required for hyaluronic acid gel injections, which appear to be effective but expensive and temporary.

## Supplementary Material

This article contains supplementary material located online at [www.aestheticsurgeryjournal.com](http://www.aestheticsurgeryjournal.com).

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