



Published in final edited form as:

Ann Plast Surg. 2022 June 01; 88(5 Suppl 5): S473–S477. doi:10.1097/SAP.0000000000003234.

The Safety of Fat Grafting: An Institutional Retrospective Review

Hua Amanda Fang, BS^{a,b}, Edgar Soto, BS, MSPH^a, Ricky Pigg, BS^a, Metta Smith, BS^a, Carter J. Boyd, MD, MBA^a, Shivani Ananthasekar, MD^a, R. Jobe Fix, MD, FACS^b, Ali Kilic, MD^b, Brad Denney, MD, FACS^b, Prasanth Patcha, MD, FACS, Meng^b, René P. Myers, MD^b, Jorge I. de la Torre, MD, MSHA, FACS^b, Sherry Collawn, MD, PhD^b

^aUniversity of Alabama in Birmingham School of Medicine, University of Alabama in Birmingham, Birmingham, AL.

^bDivision of Plastic Surgery, University of Alabama in Birmingham, Birmingham, AL.

Abstract

Background: Autologous fat grafting is a popular technique for volume replacement in the breast and face. The efficacy, safety, and complication rate of this technique at the division of plastic surgery at the University of Alabama at Birmingham will be described in this review.

Methods: An institutional review board–approved retrospective review of patients undergoing fat grafting procedures from January 2015 to July 2018 was performed. Records were reviewed for fat graft recipient site, donor site, amount grafted, and complications. Continuous variables were compared using either a *t* test or one-way analysis of variance test. Categorical data were compared using χ^2 test. A *P* value of 0.05 or less was considered statistically significant for all comparisons.

Results: A total of 396 patients who underwent fat grafting procedures of the face and body from January 2015 through July 2018 met inclusion criteria. Average amount of fat grafted for all grafts was 124.4 +/- 6.74 grams. Two hundred fifty of the grafts (62.7%) involved the bilateral breasts with an average of 140.6 +/- 93.97 g used, 70 per side. Of the 396 patients, 110 (27.8%) experienced complications. Forty three of the complications (10.9%) were considered to be major, which included hematomas/seromas, fat necrosis, dermatitis/cellulitis, and infection. No statistical differences were seen among recipient site complication rate. Types of minor complications were statistically significant per recipient sites with bilateral breasts more likely to experience asymmetry than the other recipient sites (20% for bilateral breasts vs 16% overall, *P* < 0.05). Fifty nine of the 110 patients (53.6%) had the complications reported to be resolved.

Conclusions: Fat grafting is a reliable method for volumization of the breasts and face. Minor complications were not infrequent in this case series; however, no life-threatening complications were observed. Continued work needs to be done to use fat grafting beyond traditional measures.

Reprints: Sherry Collawn, MD, PhD, Division of Plastic Surgery, University of Alabama at Birmingham, 103 John N. Whitaker Building, 500 22nd Street South, Birmingham, AL 35233. scollawn@uabmc.edu.

This study was presented as a poster at the Southeastern Society of Plastic and Reconstructive Surgeons meeting, Naples, FL, June 10, 2019.

Keywords

fat grafting; complications; adipose tissue; hematoma; volume gain; treatment outcome

Fat grafting continues to be a popular augmentation agent in the face, breasts, and other tissue deficient locations in the body.^{1,2} Recent scientific progress has allowed fat grafting to become a time-efficient option to achieve volumization, with average operating room time at 125 minutes and with high rates of satisfaction among patients.³⁻⁵ Agha and colleagues comment that there has been substantial diversity in the criteria used to determine the safety and efficacy of fat grafting between different studies and thus call into question the comparability of the current literature. In a review of 22 articles including 3565 patients, Groen and colleagues⁷ identified that the most common complications of autologous fat grafting in cosmetic breast augmentation included induration, persistent pain, and hematoma occurring at 33%, 25%, and 16%, respectively. While the procedures seem to be efficacious in the short term, there are concerns for long-term resorption, loss of volume, and future oncologic risk.⁸ Al Sufyani and colleagues⁹ suggest that complications associated with fat grafting typically are of low morbidity to patients and that patients do well in long term. In situations apart from breast reconstruction and augmentation, fat grafting provides volumizing effects in areas that have experienced large traumas and atrophy such as the face and extremities.² In addition to the perceived benefits and low costs, recent studies have demonstrated a potential regenerative effect in the grafted adipose tissue.¹⁰

Although autologous fat grafting is used by plastic surgeons to meet various reconstructive and aesthetic objectives, there is a paucity of studies that characterize the safety of fat grafting in the breast, face, and other locations.¹¹⁻¹⁴ In this study, we will analyze the success of fat grafting in our patient population and assess the complications associated with these procedures.

METHODS

Institutional review board approval was obtained, and we completed a retrospective chart review of all autologous fat grafting performed at a single institution from January 2015 through July 2018. A total of 534 patients had a fat grafting procedure of the face and body during this period. Of this group, 399 patients had completely documented records available in the electronic health record of the fat graft recipient site, donor site, and amount grafted available to our investigators. Fat harvest was generally from the abdomen, thighs, and flanks using a traditional liposuction system. Surgical complications were assessed by reviewing postoperative clinic notes for each procedure. Complications were classified by major or minor complications. Major complications included hematomas/seromas, fat necrosis, dermatitis/cellulitis, and infection. Minor complications included asymmetry, altered skin or tissue sensation, and reported postoperative donor site or recipient site pain. Asymmetry was noted if records reported patient or physician expression of asymmetry. The patient cohort was grouped into primarily fat grafting location: (1) bilateral breasts, (2) unilateral breasts, (3) face, and (4) other (abdominal scars, back, flanks, hands, buttocks, and thighs). Data were summarized using standard descriptive statistics for continuous variables

and categorical data where appropriate. Continuous variables were compared using either a *t* test or one-way analysis of variance test, depending on the normality of the distributions. Categorical data were compared using χ^2 test. IBM SPSS version 9.2 or higher was used for all analyses. A *P* value of 0.05 or less was considered statistically significant for all comparisons.

RESULTS

In this patient cohort, most of the recipient sites of fat grafting were to the bilateral breasts (63.13%), followed by unilateral breasts (25.8%), face (6.8%), and other (4.3%). Considering patient demographics, there was a statistically significant difference in age (*P* = 0.035) between the 4 groups with individuals receiving fat grafting to the face being an average age of 57.04 ± 15.48 years, while patients that underwent unilateral breast fat grafting procedures had an average age of 28.31 ± 11.03 years. The remainder of patient demographic factors was not statistically different (Table 1). The donor site (*P* = 0.08) was most commonly from the abdomen (46.5%), abdomen plus flank region (11.8%), and abdomen plus hip region (10.1%; Table 2).

Patients undergoing removal of breast implants with fat grafting replacement have also had successful results, and none of the patients had requested a second session for breast enhancement. The average amount of fat harvested was statistically different (*P* = 0.001) between the 4 groups. The average amount of fat grafted for all grafts was 124.4 ± 6.74 g (*P* = 0.002) and also statistically different with bilateral breasts using an average of 140.6 ± 93.97 g (70 g per side), unilateral breasts an average of 90.71 ± 47.28 grams, 15.9 ± 9.99 g to the face or temporal region, and lastly other locations with 261.3 ± 341.73 grams, greatly skewed by several large grafts to the buttocks (Table 3).

When looking at the type of procedure performed with fat grafting for this cohort, there was a significant difference in the number of primary reconstruction, tissue expander, implant, revision, and mastopexy procedures done between the 4 groups (*P* = 0.017; Table 3). With the bilateral breast group having mostly revisions (34%), unilateral breast has mostly primary reconstructions (27.5%), face group primary reconstruction (33.3%), and other group only fat grafting (54%). Incidence of any type of complication was 27.8% (*P* = 0.54) across all fat grafting procedures. Major complications in this study comprised fat necrosis, infection, seroma/hematoma, and cellulitis. We see that most complications were minor complications (16.7%) as opposed to major (10.9%). There was no significant difference in the incidence of major complications between the 4 groups. Notably, there was a significant difference in the incidence of minor complications between the 4 groups (*P* = 0.046) with the bilateral breast group (20.4%) followed by the unilateral breast group (13.7%), face group (3.7%), and no minor complications in the other group. The most common complication for this cohort was asymmetry (14.4%; Table 4). In our patient series, other major complications such as skin loss, paresthesia, vascular compromise, embolization, or blindness resulting from the fat injections were not reported. Fifty-three percent of the complications (59/110) were not reported to be resolved (Table 5).

DISCUSSION

Fat grafting has emerged as a useful method for contouring in aesthetic and reconstructive patients. This retrospective study sought to characterize the fat grafting at multiple body site locations by volume of fat grafted, type of procedure, and complication profile. Although it has been previously shown to be well tolerated, long-term complications have yet to be adequately assessed in a variety of procedures and graft location sites.

In this study, the average amount of total fat harvested and donated to different graft locations was statistically different as expected for the varying amounts needed to properly contour different body locations. Our average amount of 140.6 g of fat injected in breast procedures was comparable with that in study by Spear et al⁴ at 145 mL. In our study, 27 patients had facial fat grafting and the average amount of fat grafted was 15.9 mL, consistent with the range of 1 to 20 mL described in the literature.¹⁵⁻¹⁷ An important consideration in the amount of fat transfer is the retention rate of transplanted fat. For breast augmentation, studies have found fat retention rates of 47% to 65%, whereas in facial fat grafting, these same rates are closer to 40%.^{16,18-21}

It is also important to note that other procedures were done in conjunction with fat grafting in our patient population with the most common being primary reconstruction, followed by secondary revision, insertion or removal of tissue expanders, insertion or removal of implants, and mastopexy. In cases of fat grafting to the bilateral breast, only 12 patients (4.8%) had fat grafting alone with no other associated procedure. Our study focused on all patients who received fat grafting, many of which were accompanied by reconstruction or revision. Our results suggest that fat grafting to different body locations does not correlate with increased complication rates. Our overall major complication rate was 10.9%, which includes infection, seroma/hematoma, fat necrosis, and dermatitis/cellulitis. This complication profile is similar to other studies such as the 9.9% complication rate documented by Sinno and colleagues²² for gluteal augmentation and 10.5% by Condé-Green et al⁸ for general fat grafting procedures. Blindness and stroke are serious complications that can occur from facial fat grafting.^{23,24} In our patient cohort, we did not have any reports of intravascular complications from fat grafting to the face. Reported asymmetry, which also included contour deformity and undercorrection, noted during the postoperative clinic visits was the most frequent complication patients experienced in our cohort (14.4%). Both dermatitis/cellulitis and seroma/hematoma were the second leading causes of complications in our study, each at 3.3%, which is comparable with the literature.^{8,25} Accompanying procedures such as breast reconstructions, tissue expander implantation or removal, and mastopexies likely have larger incisions sites compared with fat grafting injections via fine gauge needles. Therefore, we postulate that the complication may be more likely due to surgical site infections. Seroma and hematomas being complications of fat grafting are low, but Ørholt et al²⁶ noted 0.5% hematomas and 0.1% seromas in his study with 2073 patients who underwent breast augmentation with fat grafting. The third leading cause of major complications in our study was fat necrosis, affecting 2.5% of the study. Fat necrosis is also a well-documented complication of fat grafting.^{26,27} In our study, all patients' fat necrosis self-resolved. Infection made up the lowest percentage of complication at 1.8%. Our "other" category, making up 2.3% of the cohort, included the following complications found within

the series: altered breast sensation and abdominal pain. Although a little more than half the patients who experienced complications did not report resolution, it is of note that most of the complication was due to asymmetry or dissatisfaction with contour. Swelling often occurs after fat grafting that could contribute to this, and resolution could have occurred outside of the clinic.

Lastly, analyses of large cohorts of data suggest that fat grafting was in fact preferred to breast implant therapy for minimizing short-term complication risk.¹ Advocates for fat grafting to healthy breast tissue remain cautious about potential risks of breast cancer development in these patients.^{26,28–30} These proponents emphasize the necessity of continued breast cancer screening and long-term studies to assess any potential increased risk introduced to individuals undergoing these procedures.¹

Limitations

Because of the retrospective nature of the study, we cannot fully conclude whether a complication was truly due to fat grafting if other major procedures were simultaneously performed. We documented all complications that occurred after the operation(s). Therefore, the complication rate recorded in this study may be an overestimation of the true complication rate caused solely by fat grafting. A specific instance includes a subject who underwent mastopexy with fat grafting. The patient experienced dissatisfaction with the symmetry of the breasts. To correct the asymmetry, patient underwent further fat grafting. From this case, we cannot fully conclude whether mastopexy or initial fat grafting was the cause of the asymmetry.

Future Directions

Much of the excitement surrounding fat grafting is associated with its potential to have regenerative effects due to stem cells located in the grafted adipose tissue.⁶ While further investigation is required to further outline these potential effects, the possibility of regenerative procedures could lead to an astounding number of new applications for reconstructive surgery.⁶ Worldwide, many clinical trials are underway to evaluate the regenerative potential of fat, stromal vascular fraction, and adipose-derived stromal cells.^{1,7} Future studies could explore isolated fat grafting operations from more institutions with longer follow-up. In our study, only 12 cases had fat grafting not accompanied by another procedure at a single institution over 3 years. In addition, some studies have reported using 3-dimensional imaging to monitor postoperative changes of other surgical sites.^{31,32} The face and the abdomen have discrete anatomical landmarks that can be followed via 3-dimensional imaging to monitor postsurgical progression. Besides these traditional indications, fat grafting has also been successfully used to correct a variety of other deformities. Fat grafting has been demonstrated to be effective in providing cosmesis to areas of chronic wound damage and scar tissue.^{17,18} Stem cells found in adipose tissue can be transferred by fat grafting to damaged tissue secondary to radiation injury. Studies have demonstrated that fat grafting for this purpose assists in rejuvenating irradiated tissues and stimulates wound healing.^{19,20}

CONCLUSIONS

Fat grafting can be safely performed for a variety of indications. Our analysis revealed a 10.9% major complication rate with no reports of death or fat embolism. Most complications were minor asymmetries. Continual investigation is required to use fat grafting beyond its traditional indications.

Conflicts of interest and sources of funding:

This article was funded in part by the National Center for Advancing Translational Sciences of the National Institutes of Health under award number UL1TR003096.

REFERENCES

1. Largo RD, Tchang LA, Mele V, et al. Efficacy, safety and complications of autologous fat grafting to healthy breast tissue: a systematic review. *J Plast Reconstr Aesthet Surg.* 2014;67:437–448. [PubMed: 24394754]
2. Marten TJ, Elyassnia D. Fat grafting in facial rejuvenation. *Clin Plast Surg.* 2015; 42:219–252. [PubMed: 25827566]
3. Krastev TK, Alshaikh GAH, Hommes J, et al. Efficacy of autologous fat transfer for the correction of contour deformities in the breast: a systematic review and meta-analysis. *J Plast Reconstr Aesthet Surg.* 2018;71:1392–1409. [PubMed: 30061004]
4. Spear SL, Coles CN, Leung BK, et al. The safety, effectiveness, and efficiency of autologous fat grafting in breast surgery. *Plast Reconstr Surg Glob Open.* 2016; 4:e827. [PubMed: 27622095]
5. Le JM, Bosworth JW, Honeywell B, et al. Adipose grafting for volume and scar release. *Ann Plast Surg.* 2021;86:S487–S490. [PubMed: 34100804]
6. Agha RA, Pidgeon TE, Borrelli MR, et al. Validated outcomes in the grafting of autologous fat to the breast: the VOGUE study. Development of a core outcome set for research and audit. *Plast Reconstr Surg.* 2018;141:633e–638e.
7. Groen JW, Negenborn VL, Twisk JW, et al. Autologous fat grafting in cosmetic breast augmentation: a systematic review on radiological safety, complications, volume retention, and patient/surgeon satisfaction. *Aesthet Surg J.* 2016;36: 993–1007. [PubMed: 27329661]
8. Condé-Green A, Kotamarti V, Nini KT, et al. Fat grafting for gluteal augmentation: a systematic review of the literature and meta-analysis. *Plast Reconstr Surg.* 2016; 138:437e–446e.
9. Al Sufyani MA, Al Hargan AH, Al Shammari NA, et al. Autologous fat transfer for breast augmentation: a review. *Dermatol Surg.* 2016;42:1235–1242. [PubMed: 27618391]
10. Lu Z, Yuan Y, Gao J, et al. Adipose tissue extract promotes adipose tissue regeneration in an adipose tissue engineering chamber model. *Cell Tissue Res.* 2016; 364:289–298. [PubMed: 26678825]
11. Toyserkani NM, Jensen CH, Tabatabaeifar S, et al. Adipose-derived regenerative cells and fat grafting for treating breast cancer-related lymphedema: lymphoscintigraphic evaluation with 1 year of follow-up. *J Plast Reconstr Aesthet Surg.* 2019;72:71–77. [PubMed: 30293963]
12. Jones IA, Wilson M, Togashi R, et al. A randomized, controlled study to evaluate the efficacy of intra-articular, autologous adipose tissue injections for the treatment of mild-to-moderate knee osteoarthritis compared to hyaluronic acid: a study protocol. *BMC Musculoskelet Disord.* 2018;19:383. [PubMed: 30355323]
13. Jan SN, Bashir MM, Khan FA, et al. Unfiltered nanofat injections rejuvenate post-burn scars of face. *Ann Plast Surg.* 2019;82:28–33. [PubMed: 30285990]
14. Tarallo M, Fino P, Ribuffo D, et al. Liposuction aspirate fluid adipose-derived stem cell injection and secondary healing in fingertip injury: a pilot study. *Plast Reconstr Surg.* 2018;142:136–147. [PubMed: 29649060]
15. Schendel SA. Enriched autologous facial fat grafts in aesthetic surgery: 3D volumetric results. *Aesthet Surg J.* 2015;35:913–919. [PubMed: 26242853]

16. Zhu M, Xie Y, Zhu Y, et al. A novel noninvasive three-dimensional volumetric analysis for fat-graft survival in facial recontouring using the 3L and 3M technique. *J Plast Reconstr Aesthet Surg*. 2016;69:248–254. [PubMed: 26601875]
17. Park S, Kim B, Shin Y. Correction of superior sulcus deformity with orbital fat anatomic repositioning and fat graft applied to retro-orbicularis oculi fat for Asian eyelids. *Aesthetic Plast Surg*. 2011;35:162–170. [PubMed: 20835821]
18. Lin JY, Song P, Pu LLQ. Reply: management of fat necrosis after autologous fat transplantation for breast augmentation. *Plast Reconstr Surg*. 2019;144: 701e–702e.
19. Jung HK, Kim CH, Song SY. Prospective 1-year follow-up study of breast augmentation by cell-assisted lipotransfer. *Aesthet Surg J*. 2016;36:179–190. [PubMed: 26342099]
20. Gerth DJ, King B, Rabach L, et al. Long-term volumetric retention of autologous fat grafting processed with closed-membrane filtration. *Aesthet Surg J*. 2014;34: 985–994. [PubMed: 25028738]
21. Guibert M, Franchi G, Ansari E, et al. Fat graft transfer in children’s facial malformations: a prospective three-dimensional evaluation. *J Plast Reconstr Aesthet Surg*. 2013;66:799–804. [PubMed: 23535268]
22. Sinno S, Chang JB, Brownstone ND, et al. Determining the safety and efficacy of gluteal augmentation: a systematic review of outcomes and complications. *Plast Reconstr Surg*. 2016;137:1151–1156. [PubMed: 27018670]
23. Cuzalina A, Guerrero AV. Complications in fat grafting. *Atlas Oral Maxillofac Surg Clin North Am*. 2018;26:77–80. [PubMed: 29362075]
24. Lazzeri D, Agostini T, Figus M, et al. Blindness following cosmetic injections of the face. *Plast Reconstr Surg*. 2012;129:995–1012. [PubMed: 22456369]
25. Oranges CM, Tremp M, di Summa PG, et al. Gluteal augmentation techniques: a comprehensive literature review. *Aesthet Surg J*. 2017;37:560–569. [PubMed: 28203698]
26. Ørholt M, Larsen A, Hemmingsen MN, et al. Complications after breast augmentation with fat grafting: a systematic review. *Plast Reconstr Surg*. 2020;145: 530e–537e.
27. Simonacci F, Bertozzi N, Grieco MP, et al. Procedure, applications, and outcomes of autologous fat grafting. *Ann Med Surg (Lond)*. 2017;20:49–60. [PubMed: 28702187]
28. Challapalli RS, Dwyer RM, McInerney N, et al. Effect of breast cancer and adjuvant therapy on adipose-derived stromal cells: implications for the role of ADSCs in regenerative strategies for breast reconstruction. *Stem Cell Rev Rep*. 2021;17: 523–538. [PubMed: 32929604]
29. Bielli A, Scioli MG, Gentile P, et al. Adult adipose-derived stem cells and breast cancer: a controversial relationship. *Springerplus*. 2014;3:345. [PubMed: 25089245]
30. De Decker M, De Schrijver L, Thiessen F, et al. Breast cancer and fat grafting: efficacy, safety and complications—a systematic review. *Eur J Obstet Gynecol Reprod Biol* 2016;207:100–108. [PubMed: 27835828]
31. Wu R, Yang X, Jin X, et al. Three-dimensional volumetric analysis of 3 fat-processing techniques for facial fat grafting: a randomized clinical trial. *JAMA Facial Plast Surg*. 2018;20:222–229. [PubMed: 29327032]
32. Cristel RT, Caughlin BP. Lower blepharoplasty three-dimensional volume assessment after fat pad transposition and concomitant fat grafting. *Facial Plast Surg*. 2020;36:478–483. [PubMed: 32629483]

TABLE 1.

Patient Demographic Data

	Total (N = 396)	Bilateral Breast (n = 250)	Unilateral Breasts (n = 102)	Face (n = 27)	Other (n = 17)	P
Age	51.36 ± 12.14	50.31 ± 11.24	28.31 ± 11.03	57.04 ± 15.48	40.47 ± 16.15	0.035*
Race						0.07 [†]
White	82.1%	85.2%	77.5%	81.5%	64.7%	
Black	16.2%	14.4%	21.6%	14.8%	11.8%	
Other	1.7%	0%	1.0%	3.7%	23.6%	
BMI	28.00 ± 5.74	27.88 ± 5.65	28.31 ± 6.15	26.95 ± 5.43	29.60 ± 5.02	0.706*

* One-way analysis of variance with $P < 0.05$ indicating statistical significance.

[†] χ^2 with $P < 0.05$ indicating statistical significance.

Other, Asian/Hispanic/Native American.

TABLE 2.

Donor Sites By Recipient Sites

Patient Characteristics	Total (N = 396)	Bilateral Breasts (n = 250)	Unilateral Breasts (n = 102)	Face (n = 27)	Other (n = 17)	P
Donor site						0.08*
Abdomen	188 (46.5%)	107 (42.8%)	53 (53.0%)	20 (74.0%)	8 (47.1%)	
Flanks	14 (3.5%)	3 (1.2%)	4 (3.9%)	2 (7.4%)	5 (29.4%)	
Hips	24 (6.1%)	18 (4.4%)	4 (3.9%)	1 (3.7%)	1 (5.9%)	
Thighs	23 (5.8%)	15 (6.0%)	4 (3.9%)	1 (3.7%)	3 (17.6%)	
Abdomen and flanks	47 (11.8%)	39 (15.6%)	8 (7.8%)	0	—	
Abdomen and hips	40 (10.1%)	31 (12.4%)	8 (7.8%)	1 (3.7%)	—	
Abdomen and thighs	13 (3.3%)	7 (2.8%)	5 (4.9%)	0	—	
Flanks and hips	29 (7.3%)	15 (6.0%)	14 (13.7%)	0	—	
Flank and thighs	12 (3.0%)	9 (3.6%)	2 (2.0%)	1 (3.7%)	—	
Other	6 (1.5%)	6 (2.4%)	0	0	—	
Total amount harvested	167.4 ± 162.68	177.32 ± 116.40	107.95 ± 57.57	28.86 ± 42.26	368.71 ± 479.96	0.001 [†]

* χ^2 with $P < 0.05$ indicating statistical significance.[†] One-way analysis of variance with $P < 0.05$ indicating statistical significance. Other Donor Site(s), Lower Back, Posteromedial Upper Arms, or Unclearly Defined.

TABLE 3.

Type Procedure Done With Fat Grafting

Procedure	Total (N = 396)	Bilateral Breasts (n = 250)	Unilateral Breasts (n = 102)	Face (n = 27)	Other (n = 17)	P
Primary reconstruction	123 (31.1%)	75 (30.0%)	28 (27.5%)	9 (33.3%)	11 (11.7%)	0.017*
Tissue expander	97 (24.5%)	76 (30.4%)	21 (20.6%)	—	—	
Implant	97 (24.5%)	80 (32.0%)	17 (16.7%)	—	—	
Revision	108 (27.3%)	85 (34.0%)	23 (22.5%)	—	—	
Mastopexy	41 (10.4%)	17 (6.8%)	24 (23.5%)	—	—	
Other	81 (20.5%)	48 (19.2%)	19 (18.6%)	8 (29.6%)	6 (35.3%)	
Total amount placed	124.4 ± 6.74	140.6 ± 93.97	90.71 ± 47.28	15.90 ± 9.99	261.34 ± 341.73	

* χ^2 with $P < 0.05$ indicating statistical significance.

[†] One-way analysis of variance with $P < 0.05$ indicating statistical significance.

Other procedures, fat grafting to gluteus region, bilateral extremities, earlobe reconstruction and face-lift. Primary reconstruction, breast reconstruction.

TABLE 4.

Complications Associated With Fat Grafting

	Total (N = 396)	Bilateral Breasts (n = 250)	Unilateral Breasts (n = 102)	Face (n = 27)	Other (n = 17)	P
Incidence of major and minor complication	110 (27.8%)	81 (33%)	23 (22.5%)	5 (18.5%)	1 (5.8%)	0.54*
Major						
Fat necrosis	10 (2.5%)	8 (3.2%)	2 (2%)	—	—	
Dermatitis/cellulitis	13 (3.3%)	8 (3.2%)	3 (2.9%)	2 (7.4%)	—	
Seroma/hematoma	13 (3.3%)	9 (3.6%)	2 (2.0%)	1 (3.7%)	1 (5.8%)	
Infection	7 (1.8%)	4 (1.6%)	2 (2.0%)	1 (3.7%)	—	
Minor						
Asymmetry	57 (14.4%)	46 (18.4%)	11 (10.8%)	—	—	
Other	9 (2.3%)	5 (2%)	3 (2.9%)	1 (3.7%)	—	
Incidence of major complications	43 (10.9%)	29 (11.6%)	9 (8.8%)	4 (17.8%)	1 (5.8%)	0.52*
Incidence of minor complications	66 (16.7%)	51 (20.4%)	14 (13.7%)	1 (3.7%)	—	0.046*

* χ^2 with $P < 0.05$ indicating statistical significance.

Other: abdominal pain and altered breast sensation.

TABLE 5.
Time of Onset of Minor and Major Complications and Rate of Resolution by Graft Location

	Total (N = 110)	Bilateral Breasts (n = 81)	Unilateral Breasts (n = 23)	Face (n = 5)	Other (n = 1)	P
Time of onset of complication postop to resolution (days)	136.78 ± 248.84	162.22 ± 288.22	88.62 ± 152.11	62.4 ± 102.01	14 ± 0.00	0.1112*
Complications resolved						0.06 [‡]
Yes	51 (46.4%)	46 (46.7%)	18 (78.2%)	4 (80%)	1 (100%)	
No	59 (53.6%)	35 (43.3%)	5 (21.8%)	1 (20%)	0	

* One-way analysis of variance with $P < 0.05$ indicating statistical significance.

[‡] χ^2 with $P < 0.05$ indicating statistical significance.