Evaluation of delayed lipomodelling for breast reconstruction after different oncological surgical interventions for breast cancer patients

Yasser S. Ahmed, Mohamed H. Sultan, Samy E. Ibrahim, Khaled E. Soliman, Medhat M. Anwar, Rabie R. Abdelwahed, Ahmed Karmouty, Hamza Alaa

Experimental and Clinical Surgery Department, Medical Research Institute, University of Alexandria, Alexandria, Egypt

Correspondence to Yasser S. Ahmed, Experimental and Clinical Surgery Department, Medical Research Institute, Alexandria University, 165 Horia Street, El Hadra, Alexandria, Egypt
e-mail: yasserendo30@yahoo.com

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Background
Oncoplastic techniques, autologous flaps and implants are commonly used plastic surgery techniques in patients undergoing breast reconstruction. Lipomodelling is a currently used technique to correct soft-tissue defects.
Restoring an acceptable appearance after breast cancer surgery has become an integral part of the treatment process. Even though advances in autologous and implant-based surgical techniques have markedly improved breast reconstructions over the past decennia, they have ultimately raised the patients' expectations.

Patients and methods
The study included 30 female patients undergoing delayed lipomodelling after breast cancer surgery using the Coleman technique. Patients, after mastectomy and after breast conservative surgery with tissue defect and/or deformities, will undergo delayed lipomodelling at least 6 months after completion of radiotherapy.

Results
In our study, 43 lipofilling sessions were performed in 30 patients. Twenty-four patients had invasive ductal carcinoma and six patients had DCIS. The mean amount of fat injected ranged from 50 to 400 ml and sessions of lipofilling ranged from one session to three sessions according to the indication. The follow-up interval was 16 months. The most common complication was macrocalcification and oil cyst formation in three patients. No cases of local recurrence were detected. The satisfaction rate was excellent in 36.6% and good in 43.3% of the patients.

Conclusion
Fat grafting can be used as an alternative method of breast reconstruction in selected cases as it is an easy and cheap method with a very high rate of acceptance from the patient because it is an easy day surgery technique, with minimal complications to the recipient and the donor site. An excellent aesthetic result as well as longevity can also be achieved.

Keywords:
breast reconstruction, cancer breast surgery, lipofilling

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Introduction

The psychological impact of surgery in breast cancer patients is multifactorial, the cosmetic result and body image being important factors as also the fear of recurrence of cancer. A better cosmetic result usually leads to a better psychological outcome [1].

Oncoplastic techniques, autologous flaps and implants are commonly used plastic surgery techniques in patients undergoing breast reconstruction [2,3].

Coleman [4] introduced a new refined technique of fat aspiration, purification and injection that considerably improved graft survival and reduced the rate of complications. The Coleman technique was soon adopted by most plastic surgeons worldwide and became used widely for both cosmetic and reconstructive indications [5–10].

The recent re-emerging popularity of breast fat transplantation is based on recent reports and work by a number of surgeons including Coleman and Delay, who have introduced the term 'lipomodelling', and used the technique alone or in combination with other reconstructive procedures [11].

Lipomodelling is the process of relocating autologous fat to alter the shape, volume, consistency and profile of tissues, with the aim of reconstructing, rejuvenating and regenerating body features. The terms in current use to describe the technique are micro fat grafting, fat transfer, fat injection and lipofilling [12,13].

Success depends on careful harvesting, refining and grafting of the fat. As techniques have improved, lipomodelling has become more widely applied in reconstruction following breast cancer surgery, treatment of secondary defects after breast-cancer

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reconstruction or tissue damages and deformities after radiotherapy, treatment of congenital and acquired breast deformities and recently, for cosmetic augmentation [12,13].

In this study, we aimed to evaluate delayed lipomodelling after different techniques of Surgery for Breast Cancer in terms of patient satisfaction, aesthetic results, complications, number of sessions needed and the amount of fat harvested, injected and reabsorbed.

Patients and methods

The study included 30 female patients scheduled to undergo delayed lipomodelling using the Coleman technique after surgery for breast cancer including just mastectomy, mastectomy with autologous flaps, mastectomy with implants and breast conservative surgery (BCS) with tissue defects and/or deformities [3]. The patients included had undergone delayed lipomodelling at least 12 months after the completion of radiotherapy. Lipomodelling was staged (from two to three sessions after modified radical mastectomy and one to two sessions after BCS).

Exclusion criteria

(1) General medical comorbidities that are a contraindication to repeated procedures requiring general anaesthesia such as bleeding disorders and vasospastic conditions that increase the risk of postoperative complications. The use of local anaesthesia with or without sedation may be a suitable alternative.
(2) Heavy smoker.
(3) Current use of medications such as aspirin, NSAIDs, cytotoxic and immunosuppressant drugs because of associated risks of bleeding and infection.
(4) Inadequate donor sites.
(5) Unsuitability of the recipient site.
(6) Patients actively dieting around the time of fat grafting.

Preoperative evaluation

Thirty patients admitted and operated for cancer breast in the Department of Surgery, Medical Research Institute Hospital, Alexandria University, were evaluated by clinical and radiological breast examinations (mammography and breast ultrasonography) before the lipofilling operation. All individuals agreed to participate after the objectives of the study were explaining to them and they signed an informed consent. Moreover, the study was approved by the local Institutional Ethical Committee. Preoperative photographs were taken in all cases, and all the breast defects were measured by a ruler on its two major axis, and, finally, the depth was measured by an approximate and empirical measurement.

Surgical technique

The procedure was performed under general anaesthesia. The selected donor site was infiltrated with Klein's solution [14]. It consists of 1 mm of epinephrine diluted in 500 ml of 0.001% lactate ringer solution. The amount of solution injected was double the volume of pre-estimated fat tissue requirement (Fig. 1a).

The entire procedure of fat harvesting and 'lipofilling' was performed according to Coleman's technique [3], with minimal modifications (Fig. 1).

After the injection of the diluted solution, a two-hole, 3-mm diameter Coleman's cannula with a blunt tip attached to a 50-ml Luer-Lock syringe was inserted through the small incision. A combination of a slight negative pressure and the curetting action of the cannula through the tissues allows fat harvesting. The fat was harvested until we reached the pre-estimated defect volume. Then, we obtained the fat for centrifugation at 3000 rpm for 3 min until the serum and oily components were separated from the adipose tissue.

The cellular component was immediately transferred to a 1 or a 3-ml Luer-Lock syringe and prepared for injection.

The prepared cellular component was then injected into the defect area through a blunt Coleman's cannula. A retrograde injection with a thin-layer and multiple-

Figure 1

Coleman's Technique: (a) Infiltration of donor site with Klein's solution. (b) Liposuction (abdomen) using 3 mm Coleman's cannula and 50cc Luer Lock syringe. (c) Centrifugation at 3000 rpm for 3 minutes for fat separation. (d) Products of centrifugation.Centrifugation of the lipoaspirate yields three layers, with the purified fat forming the central layer. (e) Pure fat collected and transferred to 1 mm syringes.

tunnel technique was administered. We avoided placing fat as an excessive depot, which may result in liponecrosis and graft loss.

Local factors can influence our technique approach for individual cases, especially in scarred and irradiated tissues. We broke the fibrotic scar with a sharp cannula to create the space for grafting. However, this group is more likely to have a second session for lipofilling and the second procedure in this group is usually easier as the tissue quality is improved by the first lipofilling procedure.

Clinical examination

Immediately postoperatively for the detection of haematoma, bruises and cellulite in donor site or recipient site.

At 6 and 9 months' follow-up for each patient clinically for detection of any area of palpable traumatic fat necrosis.

Radiological follow-up

Ultrasound and mammogram were performed for assessment of breast to detect any complication such as fat cyst and macrocalcifications at 6 and 12 months.

Patient satisfaction

Patient satisfaction was assessed by a questionnaire given to the patient to assess the result (symmetry with other site, softness, shape of breast, donor and recipient site complications and level of acceptance of the intervention and impact on sexual and social life).

Results

The mean age of the patients at the time of fat grafting was 39 years (range 31–48 years).

Discussion

Surgery for cancer breast can result in physical and psychological trauma to a patient; thus, preservation of good aesthetic shape after surgery is an integral part of management in these patients.

Different plastic reconstructive techniques such as prosthesis and autologous flap reconstruction are used for this purpose; however, these techniques may lead to complications in the donor or the recipient site and may require more interventions for correction of shape. Thus, the introduction of fat-free injections provided an excellent solution for correction of these deformities after different breast surgical interventions.

Fat injections were initiated in the 1980s for correction of small defects after maxillofacial surgery [4].

Coleman started the use of lipofilling by providing a description of the perfect technique for harvesting and separation of fat with minimal trauma to fat cells to preserve mature adipocyte and stem cells viable for correction of defect after conservative breast surgery (CBS).

Delaporte *et al*. [15] used Coleman's technique for complete breast reconstruction after mastectomy, with a perfect result, with injection of a larger amount of fat.

In our study, we used the Coleman technique for lipofilling as an alternative technique for autologous flap for reconstruction of defects that result from primary breast surgery of cancer breast.

After modified radical mastectomy

Complete reconstruction of the breast after mastecomy only by lipofilling started in France as a new technique by Delay. Five patients were included in our study; between two and three sessions were needed for complete reconstruction, with a moderate amount of fat injected, around 200 ml, in each setting. We performed an intervention 12 months after radiotherapy.

At the follow-up 3 months after each setting, we found that the reduction in the volume of fat was 30–37%, facilitated by the BTTC programme. We performed tattooing and nipple reconstruction after the optimal shape of the breast was achieved.

All sessions were performed as day surgery procedures.

After conservative breast surgery

One of the important applications of lipomodelling is correction of defects after CBS resulting from postoperative radiotherapy or surgery [16]. Ten cases after CBS needed one session of fat grafting that was sufficient with a median amount of fat injected of 90 ml. We performed dissection of fibrosis by a sharp needle to improve the shape of the breast.

The main problem in CBS is the fear of increased incidence of local recurrence [16,17], but in our follow-up, there was no increase in local recurrence.

After autologous flap

For correction of symmetry with other sites instead of reduction mammoplasty of the normal breast [17], we used this technique for correction of discrepancy in the size of the other breast in nine patients; this was

easier as injection into the tissue flap and correction of symmetry were satisfactory for cases with a median amount of fat (160 ml).

Our result was similar to that of Sinna *et al.*, who injected an average of 176 ml of fat and found a satisfactory result in 94% of patients [18].

After skin-sparing mastectomy with prosthesis

Six patients with implant had irregularities in the surface and thin skin over the implant; we changed the implant, with injection of fat into the layer between the capsule of the implant and the skin. The texture of the skin improved and sensation of an implant under the skin decreased.

Table 1 Clinicopathalogical data and type of primary oncological surgery

Type of primary oncological surgery	Number (%)
Mastectomy	4 (13.3)
Mastectomy with TRAM	5 (16.6)
Mastectomy with LD flap	4 (13.3)
Skin-sparing mastectomy with implant	6 (20)
Conservative breast surgery	3 (10)
	8 (26.6)
Stage of breast cancer	
Stage I	12 (40)
Stage II	17 (42.6)
Stage III	1 (3.4)
Stage VI	0 (0)
Pathology of the tumour	
IDC	22 (83.4)
DCIS	8 (26.6)

TRAM, transverse abdomens myocutaneous.

Cigna *et al.* [19] injected a skin envelope overlying implant for correction of complications of radiation and to decrease the extent of complications of implant reconstruction after irradiation [19,20].

Follow-up

Two of our patients had cellulite at the donor site and they were treated with antibiotics and dressing.

On mammogram follow-up, there were microcalcifications and oil cyst in four patients.

On oncological follow-up, no cases of local recurrence were found at a median follow-up of 16 months, similar to the result of the study carried out by Petit *et al.* [21].

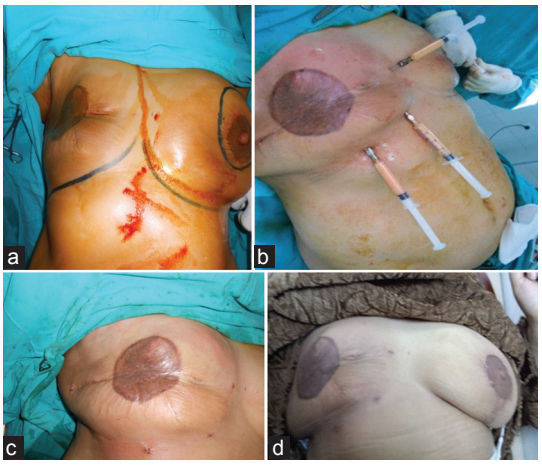
Table 2 Volume of fat and type of surgery

Surgical techniques	*N* (%)
Anaesthesia	
General	23 (76.6)
Local	7 (23.4)
Donor site	
Abdomen	25 (83.3)
thigh	4 (13.3)
buttock	1 (3.3)
Average amount of fat injected (ml)	
<100	8 (26.7)
From 100 to 200	12 (40)
From 200 to 300	6 (20)
>300	4 (13.3)

Figure 2

(a) 42 years old patient operated since 1.5 years by skin sparing mastectomy and immediate reconstruction with silicone implant inserted subpectorally (removed 2 weeks later after being infected) and contralateral reduction mammoplasty (Preoperative photo). (b) Immediately postoperative after injection of 200 cc of purified fat. (c) 1 week postoperative. (d) 1 month postoperative.

Figure 3



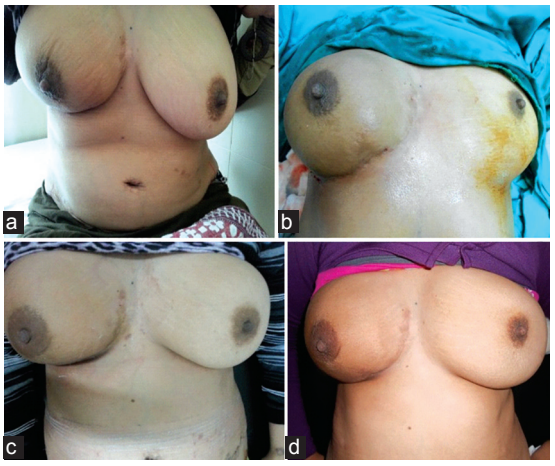
(a) After 3 months amount of fat grafted was reduced by 40% and the areola was made by skin tattooing (Preoperative photo). (b) Fat grating using 1,5 mm cannula and 3 cc Luer Lock syringes (injection is multidirectional at different levels on withdrawal of the cannula). (c) Immediately postoperative after injection of 410 cc of purified fat. (d) 1week postoperative.

Table 3 Patient satisfaction

Type of surgery	Satisfaction				
	Poor	Fair	Good	Excellent	No
MRM	0	1	2	2	5
SSM + autologus flap	1	1	3	4	9
SSM + flap	1	0	5	0	6
CBS	0	2	3	5	10
Precentage	6.6	13.3	43.3	36.6	

MRM, modified radical mastectomy; SSM, skin-sparing mastectomy.

Figure 4



(a) 34 years old patient with NSM and TRAM Flap undergoing lipofilling for asymmetry (Preoperative photo).(b) Immediatelypostoperative after injection of 200 cc of purified fat. (c) 1 week postoperative. (d) 1 month postoperative

Figure 6

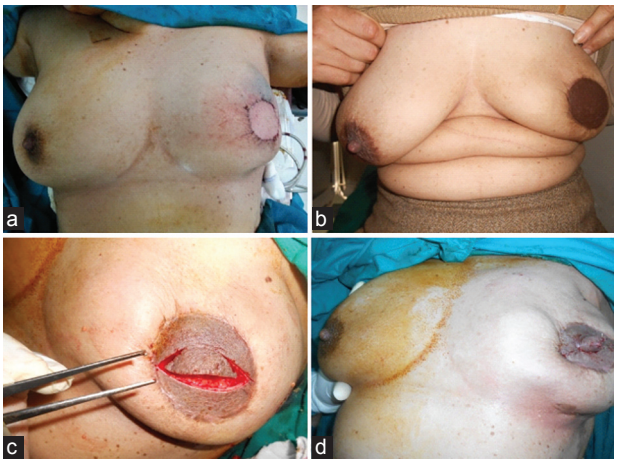
(a) 37 years old patient after BCS using oncoplastic technique (round block mammoplasty) for delayed lipofilling for correction of defect at upper outer quadrant (marked by a circle) and asymmetry (Preoperative photo). (b) Immediately postoperative after injection of 130 cc of purified fat. (c) 1 month postoperative.

Patient satisfaction

36.3% of our patients achieved an excellent result, whereas 43.6% achieved a good result in terms of the shape of the breast and ease of the procedure as it was a day surgery and there were minimal complications to the donor and recipient site.

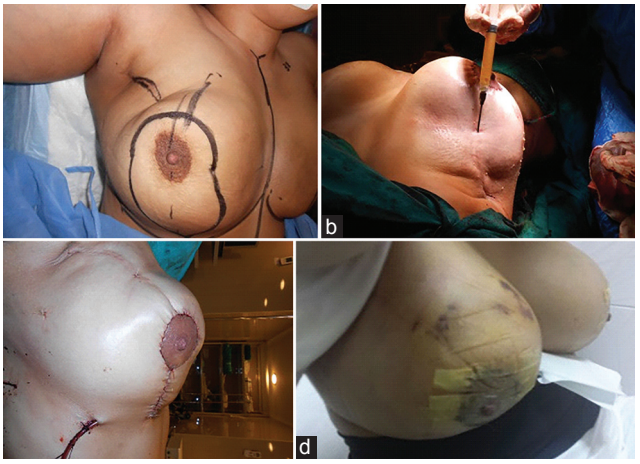
The BCS and skin-sparing mastectomy group that received an autologous flap reported greater satisfaction as they achieved the perfect shape in one session, with minimal to moderate amount of fat injection and fewer complications to the donor or recipient site. However, the mastectomy group reported the least satisfaction as more sessions and a large amount of fat injection were required, and they did not achieve the expected result.

Figure 5



(a) 53 years old patient with retroareolar breast cancer operated with skin sparing mastectomy with immediate LD flap reconstruction. (b-d) 6 months later nipple and areola reconstruction after tattooing and lipofilling by 230 cc fat for augmentation.

Figure 7



(a) 32 years old patient with quadrantectomy, after 28 months of adjuvant chemotherapy and radiotherapy. (b,c) correction of deformity by injection of 210 cc of fat. (d) one week postoperative.

Conclusion

Fat injection is a new promising modality among reconstructive techniques for breast reconstruction after different types of oncological surgical management of cancer breast, involving scarless day surgery procedure and minimal complications to the donor and recipient site, with excellent patient satisfaction.

It is a perfect solution in cases of CBS or skin-sparing mastectomy with an autologous flap, but in the cases of mastectomy, it can be considered a preparatory step for correction of the quality of skin after radiotherapy, followed by insertion of a small-size implant (Tables 1–3 and Figs. 2–7).

Acknowledgements

Conflicts of interest

None declared.

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