Current Techniques in Fat Grafting

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KEYWORDS

• Fat grafting • Atraumatic technique • Adipocytes

KEY POINTS

- Fat grafting is a foundational esthetic procedure that remains relevant nearly a hundred years after its advent.
- Atraumatic technique is the mainstay of predictable fat grafting.
- Smaller fat parcels (less than 3 mm) have greater chance of graft survival.
- Adipocytes may be harvested from any fat reservoir in the body. Primary concerns for donor site selection are the patient's convenience and the surgeon's preference.
- Fat transfer may be injected into different levels (ie, supraperiosteal, intramuscular, or intradermal) according to the needs and treatment goals.

Introduction

Fat grafting is a versatile aesthetic procedure that has significantly evolved since its advent nearly hundred years ago and is a growing trend in facial aesthetic surgery.[1]

In 1893, Gustave Neuber[2] was the first surgeon to use small pieces of adipose tissue to elevate a depressed scar. Thereafter, in the 1950s, Peer[3] proposed the fat survival theory, building the scientific basis for the advent of conservative surgical techniques for fat grafting. According to Peer's principles, adipocytes should be manipulated carefully to preserve viability, and fat graft particles must be tiny to allow for easy diffusion for revascularization.

In 1986, Illouz[4] presented the innovative idea to reinject liposuction material into wrinkles and any deficient areas of the face. This led to the advent of new era in fat grafting based on application of cannula to obtain fat, concentrating harvested fat, and injection of processed fat into facial tissues.[4,5] Unfortunately, early reports of this technique and its modifications showed disappointing and unpredictable results, along with swift resorption of graft.[6,7] In 1991, Ersnek tried to process the harvested fat by using a whisk and washing the graft to remove broken cells and oil. Surprisingly, this seemingly logical modification resulted in almost total graft failure and loss.[7] Coleman[8,9] endeavored to standardize fat grafting techniques using minimal negative pressure in a syringe to shield adipocytes from exposure to atmosphere. He reported his long-term success in nasolabial and lip augmentation in 1995.[9] This report, along with his subsequent technique modifications, helped popularize fat grafting again.[8–10]

Fat grafting techniques are usually divided into 3 stages: fat harvesting, fat processing, and fat transfer.[1] The 3 most common methods to achieve these 3 stages include centrifuge, washing and filtering, and sedimentation. Though there is no consensus on the most effective approach, current literature shows that meticulous conservative handling of adipocytes with strict attention to known techniques will provide predictable results.[11–15] This concept is the backbone of this article.

Preoperative preparations

Medical optimization

As with all procedures, a thorough medical history and physical examination is necessary and should focus on major medical conditions, bleeding disorders, and history of drug use. The patient must be able to undergo general anesthesia, particularly in cases of larger fat grafting. Aspirin and other nonsteroidal antiinflammatory drugs should be withheld 2 weeks before surgery, as should smoking, which may adversely affect graft survival. Vitamin E and select herbal products that interfere with bleeding should also be discontinued preoperatively.

Patient expectations must be clearly elucidated and managed. In some extremely lean patients, such as professional athletes, fat reservoirs can be inadequate. Preoperative weight gain or treatment plan modification might be necessary. If the patient is able to gain wait, he or she must be willing and able to maintain this weight after the procedure.[16–18]

Disclosure Statement: The authors have nothing to disclose.

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https://doi.org/10.1016/j.cxom.2017.11.001

Photography
Standard preoperative photographs serve 2 useful functions. First, they assist with patient communication, particularly when determining patient expectations and helping to explain procedural risks and benefits. Second, photographs can detect and document donor site deformities and asymmetries that are neglected in the initial preoperative interviews and physical examination, despite the surgeon's best efforts.[18]

Donor site assessment and selection
Donor sites should be thoroughly evaluated preoperatively as scar asymmetries or tissue deformities can necessitate a site change.[1] Lateral or medial thigh, abdomen, and flanks are usually used to obtain fat grafts. Some investigators think that fat is best obtained from reservoirs that are resistant to diets.[17] Others think the medial knee has the least amount of elastin fibers and provides the best quality of harvested fat.[19] However, this has not been shown to provide statistically different results[14,20–22] and recent well-designed studies clearly show that there is no difference in harvested fat quality from various donor areas of the body.[20–22] Ease and access for surgeon, along with patient convenience, determine the best donor site. It is imperative, however, to avoid adhesion zones in any donor region.[23,24]

Adhesion zones
Adhesion zones are comprehensively described by Rohrich and colleagues[24] and are an accepted concept for graft harvesting. These zones consist of areas of fibrous extensions that connect deep fat compartments to the epidermis. Fat harvesting in these areas can be difficult or traumatic. It also has the potential to result in donor site irregularity and unintended contour changes. Best practices indicate preoperative marking and avoidance of these areas (Fig. 1).[23,24]

Surgical technique

Graft harvesting
The wetting solution, which usually contains a solvent (normal saline or Ringer lactate) combined with a local anesthetic, aids in graft retrieval via adipocyte suspension and provides local hemostasis and pain control. For smaller cases performed under local anesthesia, the wetting solution usually contains 500 cm^3 of normal saline, 25 cm^3 of 2% lidocaine with 0.5 cm^3 of epinephrine 1:100,000. If larger amounts of fat are planned for harvesting, grafting is performed under general anesthesia and the wetting solution remains 25 cm^3 of 1% lidocaine with 0.5 cm^3 of epinephrine 1:200,000.[1,16]

Graft retrieval
The harvested fat volume at the donor site is estimated and an equivalent volume of wetting solution is precisely measured and then infiltrated into the donor site (Fig. 2). After 10 to 15 minutes, a 5 mm stab incision is made with a No. 11 blade to assist with gentle insertion of a blunt, fat harvesting cannula. This cannula is usually 1 to 3 mm and is connected to a Luer-lock 10 cm^3 syringe. Fat is removed by creating slight negative pressure and gentle back and forth movements of the hand while pulling the plunger back to the 1-2 cm^3 mark on the syringe (Fig. 3). After filling each 10 cm^3 syringe with fat, the cannula remains in place while the filled syringe is removed and replaced until the complete amount of graft is obtained. Alternatively, a cannula may be connected to a closed suction machine and harvesting done using a low negative pressure setting.[25,26]

Important points in graft retrieval
- Dry approach to fat harvesting is frequently reported to be effective. Blood has the potential to cause donor site morbidity and can negate the method's advantages.[27]
- In syringe-assisted harvesting, it is recommended to pull back the plunger a maximum of 1-2 cm^3 marks while the cannula is inserted into the donor tissue.
- In a closed-suction system, low tension may be applied by adjusting the suction machine, but shear stress over adipocytes may endanger viability of the graft despite a low setting.[17,28]
- In large volume harvesting, multiple donor site can be considered to avoid deformities.[1]

Graft processing

The aim of the graft procedure is to prepare a well-concentrated, viable solution of fat cells. This is achieved by removing redundant components in the harvested fat such as blood, local anesthetics, destroyed fat cells, and oil. Many techniques are advocated to effectively refine

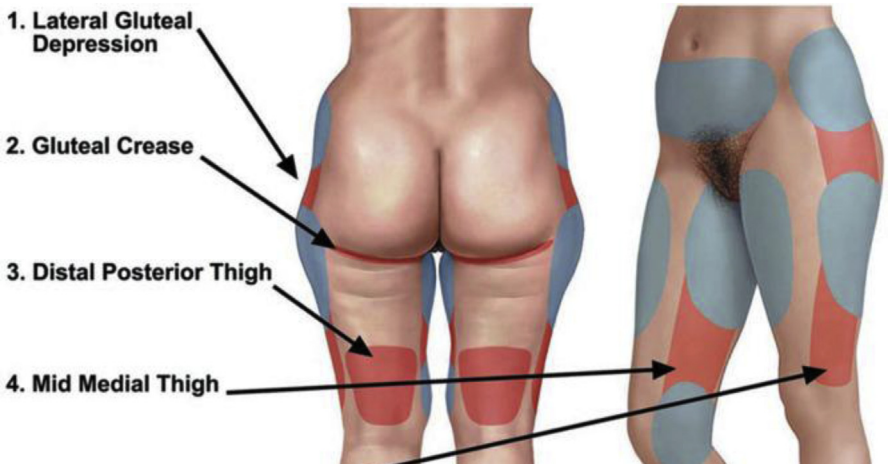

Fig. 1 Best practices indicate preoperative marking and avoidance of these areas. (*From* Rohrich RJ, Smith PD, Marcantonio DR, et al. The zones of adherence: role in minimizing and preventing contour deformities in liposuction. Plas Reconstr Surg 2001;107:1564; with permission.)