

Fat transfer in aesthetic plastic surgery

Fat transfer, also referred to as fat grafting and lipofilling, has become widely accepted as an ideal means of soft-tissue filling, as transferred fat is biocompatible, non-allergenic, non-toxic and relatively easy to obtain. Since the 1990s, plastic surgeons have increasingly and reliably used fat transfer as a way to improve and enhance the appearance of the face, breasts, hands and buttocks. However, more recently, clinicians have documented the therapeutic benefits of fat grafting in the healing of wounds and scars, as well as fat's ability to repair damage to breast tissue following radiation treatment. Olivier Branford provides an overview of fat transfer and its safety, efficacy and indications

Fat transfer is the surgical process by which fat is transferred from one area of the body to another. The technique involves extracting adipose fat via liposuction (providing an additional contouring benefit), processing the fat, and then reinjecting purified fat into another area resulting in cosmetic enhancement. The surgical goal is to improve or augment the area where the fat is injected.

History of fat transfer

Fat transfer was first reported by a German plastic surgeon, Gustav Neuber, in 1893, who transferred fat from the arm to the orbital (eye) region to correct scars formed from osteomyelitis (bone infection). However, fat grafting had trouble gaining acceptance during the next 90 years due to the many complications that routinely accompanied the procedure. Modern liposuction techniques had not yet been developed or standardised, and the extracted fat was generally of inconsistent quality, yielding poor results.

The procedure was later refined by French surgeon Yves-Gerard Illouz, who pioneered liposuction in the 1980s. Plastic surgeon Sydney Coleman also demonstrated techniques for long-term fat graft stability, publishing papers describing standardised techniques for fat extraction, processing and injection. Since then, the procedure's popularity has only increased along with a wider variety of clinical applications.

Recent reviews have assessed the highest level studies supporting the techniques used in fat transfer (Sinno et al, 2016).

Fat grafts have increasingly captivated the attention of plastic surgeons not only due to their aesthetic capabilities, but also because of their regenerative properties. The regenerative effects are due to the high concentration of mesenchymal stem cells present in the fat tissue.

In the US, there has been a 21% increase in the use of fat grafting since 2000 (American Society for Plastic Surgeons, 2017).

Who performs fat grafting and where?

Fat grafting is most commonly performed by plastic surgeons, as liposuction is a primary component of the procedure, with its associated risks. Plastic surgeons are comprehensively trained in the standards of care for liposuction and are fluent in managing complications.

In the UK, fat grafting should be performed in a facility or hospital that is inspected at regular intervals by the Care Quality Commission (CQC), to ensure patient safety and best practices, by plastic surgeons who are on the specialist General Medical Council register for plastic surgery.

How it works

Fat grafting involves three steps:

- ▶ Extraction of the fat from the donor area with liposuction
- ▶ Decanting, centrifugation and processing of the fat
- ▶ Reinjection of the purified fat into the area needing improvement.

First, fat is extracted from a donor area using liposuction techniques. This is best accomplished by manual methods, using thin liposuction cannulas with small holes

through small stab incisions which require a single absorbable suture for closure, leaving minimal scars. Although initially 10 ml syringes were used, larger syringes or liposuction devices may be used for harvest (*Figure 1*), accelerating the process. There is no evidence that there is any difference in cell viability between syringe aspiration and liposuction for aspiration harvest techniques (Sinno et al, 2016).

An infiltrate of local anaesthetic and adrenaline in a crystalloid solution is used in approximately a 1:1 volume of infiltrate to fat harvest. This ensures postoperative pain relief and minimises bruising. Although there is a temporary effect on the fat cells from using local anaesthesia, there is no effect on overall fat viability. Once the aspirate becomes bloody, harvest in that area is discontinued. The flat of the other hand is used to create tension in the skin to avoid tunnelling and contour irregularities during harvest.

Second, the fat is then processed with decanting and centrifugation to separate oil, excess fluid and blood from the viable adipose fat cells. An increasingly popular and more rapid method, particularly when processing higher volumes, is to wash the fat with a sterile saline solution using an incorporated filter. However, there is no evidence that washing or centrifugation is superior in terms of fat viability (Sinno et al, 2016).

In the final step, the fat is reinjected in small droplets with even distribution by fanning in a three-dimensional lattice, laterally and throughout the depth of the subcutaneous tissue of the recipient area, using 1 ml (for the face) to 10 ml syringes (for the body). This is to ensure a sufficient blood supply to every fat droplet so that the fat graft can survive.



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The amount of fat injected is measured in ml, and ultimately varies according to each patient's case specifics and the area of the body where the processed fat is being injected. Fat injection is halted once there is free passage of the cannula suggesting that the tissues are saturated with fat, when the desired improvement is reached, and before the tissues become turgid.

Types of anaesthesia

The choice of anaesthesia usually depends of the volume of fat that is extracted from the donor area via liposuction. Extraction of small volumes of fat can be tolerated using a local anaesthetic with or without sedation. However, and more typically, larger volumes almost always require that the patient receives general anaesthesia.

Visibility of results

Between 50–80% of the transferred fat is retained long term, with final results visible by 6–12 weeks once the swelling subsides and non-viable fat is reabsorbed. The procedure may be repeated at 3-monthly intervals to achieve the desired volume increase. Fat retention may be augmented in the breast with an external suction expansion device; however, this is not routinely used as some patients and their surgeons find these cumbersome.

Consultation

The consultation for fat grafting involves making an assessment of the volume of fat required—approximately twice the volume of fat needed for injection needs to be harvested as the volume is reduced by half during preparation. Donor sites (where the fat is taken from) are then assessed and agreed on with the patient. This may involve taking fat from more than one area and should be done symmetrically.

Typical areas for fat grafting are the flanks, abdomen, lateral thighs (saddle bags) and inner thighs, but fat can be taken from anywhere with excessive deposits. The hip area is avoided in women to maintain a feminine natural curve, with fat taken above and below this area. The inner thigh is prone to contour irregularities and should always be conservatively harvested. The lateral thigh is an excellent donor site, with typically plentiful fat to harvest, which may be taken close to the deep fascia, avoiding contour



Figure 1. Syringes containing harvested fat

problems. Harvest location does not affect long-term viability (Sinno et al, 2016).

Although laboratory and animal studies suggested that fat transfer could be risky in the breast, medium-term studies in large numbers of women with high-level evidence have not shown any increase in breast cancer (De Decker et al, 2016; Sinno et al, 2016). The recommendations are that it should be performed in experienced hands with good radiological support (Delay et al, 2009).

Indications

Face (0.3–27 ml per area)

- ▶ Restores youthful appearance by adding volume to hollowed out or wrinkled areas, such as below the eye and the nasolabial folds
- ▶ Helps repair scars
- ▶ Adds volume to the cheeks where it is lost as a result of ageing and to create the appearance of higher cheekbones
- ▶ Improves the texture and appearance of the skin.

Breast (up to 400 ml to each breast depending on initial volume and if an external suction expansion device has been used)

- ▶ Increases the breast size by one or two cup sizes
- ▶ Corrects asymmetry

- ▶ Repairs radiation tissue damage and can treat breast implant capsular contractures
- ▶ Helps correct scar deformities and contour irregularities from lumpectomy or breast reconstruction
- ▶ Augments the cleavage area following breast augmentation.

Buttocks (200–1300 ml or more to each buttock)

- ▶ Makes buttocks appear more pert
- ▶ Augments buttock size (also known as the Brazilian butt lift).

Hands (5–10 ml per side)

Reduces wrinkles and rejuvenates appearance, hiding the more obvious veins that appear with age as the subcutaneous tissue thins.

Scars in any area

Depressed adherent scars, such as those found on the abdomen following previous surgery, may be found on the abdomen and can be improved by fat grafting using the Rigotti technique (named after Italian surgeon Gino Rigotti). Using this method, a needle is used to cut the deep scar attachments, and the contour is restored and skin prevented from becoming adherent by fat transfer to the released areas.

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Fat transfer as an adjunct to other procedures

A recent study demonstrated the efficacy of using fat transfer to augment the cleavage area in a natural way, correcting asymmetries and the 'gap' that often results from breast augmentation where the breasts lie more laterally (Largo et al, 2014). This has previously been very difficult to correct using implants alone.

Composite breast augmentation involves using breast implants and fat transfer, with the fat providing soft tissue cover, and the implants providing core volume projection, giving a more natural appearance in those with little breast tissue (Serra-Mestre et al, 2017).

Fat is commonly used in conjunction with facelifting to restore volume, resulting in a more natural appearance, as facial ageing involves loss and redistribution of fat.

Contraindications

Fat transfer is contraindicated in smokers due to a large reduction in fat viability after transfer, rendering the procedure ineffective. Smoking should be discontinued for a minimum of 6 weeks prior to surgery, and at least 2 weeks after.

Very slim patients may have little fat to harvest. Those who are not fit for general anaesthesia are also advised not to have fat transfer.

Complications

Complications may be related to the donor site, which is often bruised, with bruises typically lasting a week for every decade of the patient's age. There may also be contour irregularities in the harvest areas if too much fat is removed or if this is done too superficially in the subcutaneous tissues. This may be prevented by harvesting smaller more evenly distributed volumes.

Life-threatening complications may occur during liposuction, such as bowel perforation or pneumothorax, hence the procedure should be performed by fully trained plastic surgeons.

Fat reabsorption occurs in all cases to some extent (20–50%) (Largo et al, 2014), particularly if the fat is not distributed evenly in small aliquots, and if the capacity of the tissues is exceeded. Excessive volumes of fat transfer that are greater

than the graft-to-capacity ratio may result in less fat being retained.

Fat necrosis may occur (5% of cases), which may become infected (1% of all cases) and drain out through a wound, or may harden and be felt as a lump (De Decker et al, 2016). This is detectable using ultrasound and normally softens over 12–18 months, but liposuction may be required to encourage resolution if persistent.

Fat transfer vs fillers

Both dermal fillers and fat are useful in the face. Fat is longer-lasting, whereas commonly used modern fillers offer temporary results. However, fat usually requires some form of anaesthesia due to the liposuction element of the procedure, whereas fillers are performed in the clinic setting.

Larger volumes of fat are required for the same volumising or lifting effect in the face. Fat may be lumpy and finer cannulas should be used here, particularly where skin is thinner. Fillers should not be used in the breast as there is no evidence to support their efficacy or safety in this area.

Conclusion

Fat transfer has revolutionised plastic surgery in all treated areas, as a natural way of enhancing results, when used as an adjunct to other procedures or alone. This is a rapidly changing area with many studies being published supporting its efficacy and safety, with high-level evidence from medium-term studies in large numbers of patients supporting that fat grafting is efficacious and safe in experienced hands. Preoperative imaging is recommended for breast surgery, although there is no absolute evidence-based consensus as to what age this should be commenced. Fat grafting registries are key to future analyses of safety. **JAN**

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CPD reflective questions

- ▶ Who would you refer for fat transfer in your daily practice?
- ▶ What are the advantages and disadvantages of surgical fat transfer relative to non-surgical techniques?
- ▶ What areas of the body would benefit from fat transfer and why?

Key points

- ▶ Fat transfer provides a safe, biocompatible way to enhance natural results when used alone or in combination with other procedures
- ▶ As fat transfer involves liposuction, this should only be carried out by fully trained and registered surgeons, and usually requires general anaesthesia
- ▶ Compared with dermal fillers, larger volumes of fat are required in the face, but the results last longer
- ▶ Fillers should not be used in the breast