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Facial Augmentation With Structural Fat Grafting

Sydney R. Coleman, MD

One hundred years ago, surgeons used subcutaneous fillers extensively for altering facial and body proportions [1,2]. This practice continued until the 1920s when complications resulting from injected paraffin and other substances became obvious. Aesthetic surgeons, disillusioned with available fillers, generally abandoned the restoration of fullness as a means of rejuvenation after 1920 and began to focus almost entirely on surgical procedures to remove the signs of aging. Advances in autologous fat grafting in the past 2 decades, as well as safer synthetic fillers, give us a chance to reexamine rejuvenation by restoring the fullness of youth.

Most physicians in the recent past have approached fillers in the face by filling wrinkles, troughs, or holes. But 3-dimensional augmentation of the face for rejuvenation and recontouring is much more complicated than filling a hole. To restructure with fat grafting, the surgeon must not only be proficient in maximizing fat survival after placement, but also must sculpt in a totally free-form fashion from the facial bones to skin.

Development of fat grafting

Fat grafting has been used successfully for soft tissue augmentation since 1893 [3]. In 1896, Silex claimed good cosmetic results in the treatment of periorbital scars with grafted fat. He released skin adherent to bone and grafted small pieces of fat between the bone and skin [4]. In 1908, Eugene Holländer (1867–1932) from Berlin first described a technique for using a needle and syringe to transplant fatty tissue [5]. Four years later, Holländer, who described the first face-lift [6], published photographs of two patients with lipoatrophy of the face, which was corrected with infiltration of fat using his method [5]. Charles Conrad Miller in 1926 described grafting fatty tissue through hollow metal cannulas as a substitute for the subcutaneous injection of paraffin

New York University School of Medicine, 44 Hudson Street, New York, NY 10013, USA
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E-mail address: lipostructure@yahoo.com

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and Vaseline [1]. He reported that infiltrated fat gave a better long-term correction and a more natural-appearing change in facial and body contours than paraffin. He claimed that using his technique to deposit fat through a cannula gave better results in many situations as compared with implanting fat through large incisions. Even though Conrad Miller reported good results with the injected fat, the technique he described never became popular.

Soon after the early descriptions of suction curettage of fat for body contouring [7,8], Chajchir and Benzaquen [9] described injecting suctioned fat into the face. At about the same time, Teimourian and Illouz [10–12] described their experiences with the injection of semiliquid fat into iatrogenic liposuction deformities. Although some initial impressions of fat grafting were positive [13–16], many of the early pioneers of fat grafting were not enthusiastic about the results with their specific techniques [11,17]. Illouz [11,18] compared the longevity of injecting fat into the face as similar to the longevity of injected collagen. In the late 1980s editorials appeared in the plastic surgery literature by well-respected plastic surgeons denouncing fat grafting though injection based on the early negative results [19,20]. Instead of considering why their technique might not be working, surgeons such as Ellenbogen and Ersek [21,22] publicly denounced the concept of fat grafting as an intrinsically faulty procedure. With more experience, they later changed their technique and obtained positive results [23,24].

Gradually, surgeons have come to realize that transplanted fat can create not only satisfying changes in contour, but also long-lasting results [24–27]. As in every surgical procedure, the success of fat grafting is dependent upon many factors: the techniques and instruments used to harvest, refine, and place fat into the donor site is obviously important, but also important are the volumes of implantation, the sites implanted, the levels of placement, and even the individual patient. In 1926, Dr. Conrad Miller warned, "the end-results in free fat transplantation depend, aside from various local and general factors, on the method and technique" [1]. These words are as much a key to successful fat grafting (as well as every surgical procedure) now as they were 80 years ago. Paying careful attention to technique from 1987 to 1994, I developed the following method for the reliable subcutaneous transplantation of autologous fat, emphasizing respect for handling tissues and basic sound surgical technique.

Structural fat-grafting technique

Harvesting

These steps used to harvest, prepare, and transplant fragile fat tissue have been previously described in exhaustive detail [28–30]. Fat should be harvested as intact tissue parcels that can be inserted through a small cannula but large enough to maintain tissue architecture. Harvesting sites are selected only to enhance body contour, as no clear correlation between donor site location and longevity of the implanted tissue has been demonstrated [31,32]. A No. 11 blade scalpel creates 3- or 4-mm incisions for access. Then a blunt Lamis infiltrator distributes solution into the donor sites. The choice of solution depends on the donor areas and on the projected volume of fat to be removed. For harvesting smaller volumes, local anesthesia using 0.5% lidocaine with 1:200,000 epinephrine is adequate. For larger volumes under local anesthesia with sedation, a solution of 0.25% with 1:400,000 epinephrine is used. Under general or epidural anesthesia, Ringer's lactate with 1:400,000 epinephrine is infiltrated into the donor sites to aid in hemostasis. Approximately 1 mL of solution is infiltrated for every mL of fat to be harvested. Superwet or tumescent techniques should not be used during the harvesting phase since the motion of the harvested fat through large amounts of liquid may break up the parcels of fatty tissues and thereby decrease the potential survival of the subcutaneous tissues.

Fatty tissue is harvested through the same incisions used for infiltration of anesthetic solutions. These incisions are just large enough (usually 2 to 3 mm) to permit insertion of the tip of the harvesting cannula. Fat harvested with this specific technique is with a 10-mL syringe attached to a two-holed Coleman harvesting cannula with a blunt tip (Fig. 1). Larger syringes are more cumbersome and may create damaging negative pressures. During the removal of fatty tissue, care is taken to minimize mechanical trauma to the fragile parcels of fat. A combination of slight negative pressure and a curetting action allows parcels of fatty tissue to move through the cannula, through the Luer-Lok aperture, and into the barrel of the syringe with minimal mechanical damage.

Plunger-locking devices should never be used during harvesting for transplantation. The high vacuums created by these devices or by pulling back too far on the plunger can increase the negative pressure dangerously. This can bring the pressure in the syringe to the point of vaporization, which will obviously damage the fatty parcels of tissue.

Refinement and transfer

After the fat has been harvested, the cannula is removed from the syringe and replaced with a Luer-Lok plug to prevent spillage during centrifugation. After the sealing the syringe, the plunger is removed from the proximal end of the syringe. The syringe is

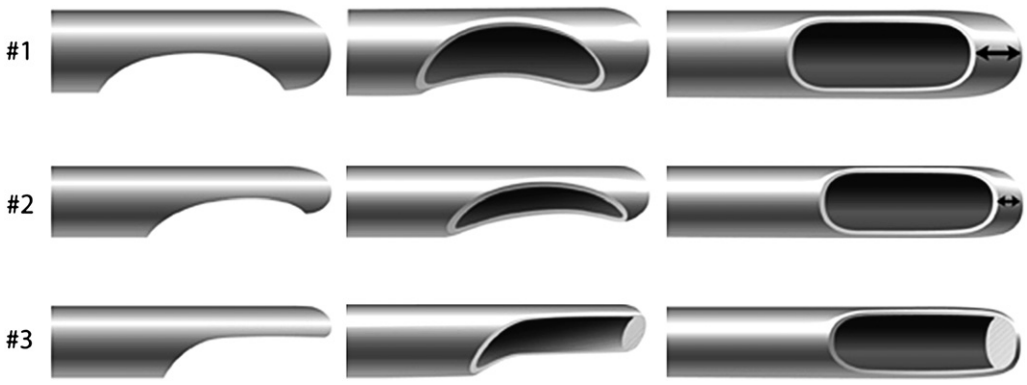

Fig. 1. The Coleman cannula. (*From* Coleman S. Structural fat grafting. St Louis (MO): Quality Medical Pub; 2004; with permission.)

then centrifuged for 3 minutes at 3000 rpm to separate the viable from the nonviable components. The oil layer is decanted and the aqueous component drained. Porous paper or neuropads can then be used to wick off the remaining oil. Care should be taken not to allow the material from the wicks to shred off into the refined tissue. The refined, unwashed fat is then transferred to 1-mL Luer-Lok syringes for use in the face or dorsum of the hands.

Placement

Either general anesthesia or combinations of regional and local anesthesia are the choices for facial anesthesia during placement. The positioning of incisions allows placement from at least two directions into each area grafted. A blunt 18- or 17-gauge cannula with one distal aperture just proximal to the tip is most commonly used for structural fat placement. The shape of the tip, the length of the cannula, and the curvature of the cannula can be altered as needed. Using a blunt Type I Coleman infiltration cannula and a 3-mL syringe, the local anesthesia is infiltrated through the same incisions that will be used for placement of the fat. Vasoconstriction from epinephrine lessens bruising, hematomas, and intravascular embolization of the transplanted fat [33]. Sharp needles are avoided in the subcutaneous planes for injection of local anesthesia or fat.

The blunt infiltration cannula is attached to the 1-mL Luer-Lok syringe filled with the refined tissue. The cannula is inserted through the incisions and advanced through the tissues to the appropriate plane. Unlike the sharp tip of a needle, the blunt cannula tip does not cut a newly defined channel through the recipient tissues but follows more natural tissue planes. As the cannula is withdrawn, fatty tissue is injected into the pathway of the retreating cannula. No fat is placed during advancement of the cannula to avoid placement of the fat in clumps and to encourage nutrition and integration of the grafted tissue by placement in small aliquots. Fundamental to this technique is the placement of fat in tiny aliquots from one tenth of a milliliter to as little as one fiftieth of a milliliter with each pass of the cannula.

Placing the fat in small aliquots maximizes the surface area of contact between the surrounding tissues and the grafted fat. This allows each parcel of fat access to a blood supply and a greater possibility to anchor in a more stable fashion in the new site. Such placement enhances the potential for survival, encourages stability, and minimizes the possibility of visible or palpable irregularities. Dramatic volume corrections are possible by making many passes of the tiny aliquots in one procedure, but this requires time and patience and results in remarkable and prolonged swelling.

Postoperative care

The most expected sequela of fat grafting using this technique is swelling. The many passes of a blunt cannula used for placement of the refined tissue results in remarkable tissue edema. Immediately after the procedure, plastic adhesive tape or Tegaderm (3M, St. Paul, MN) is placed over the infiltrated areas. This remains in place for 3 or 4 days and appears to reduce bruising and swelling. For 72 hours postoperatively, cold should be applied frequently and all infiltrated sites should be elevated.

Light touch can be instrumental in reducing swelling by encouraging lymphatic drainage. However, deep massage of infiltrated areas should be approached with caution in the first weeks after placement. Although it is difficult to move the recently infiltrated fat with gentle manipulation of the area, strong directed pressure could move infiltrated fatty tissue.

Other maneuvers such as holistic medications, low-level laser [34], and electromagnetic therapy [35] may also accelerate the resolution of swelling.

Even with all of these maneuvers to reduce edema, postoperative swelling is still a major factor. Although some physicians report a few days to 2 weeks for recovery from fat grafting [36], my experience is that the recovery can be much longer [37,38].

Complications

A surgeon should be aware of the potential complications be able to avoid them, to minimize untoward effects such as swelling, and to provide an adequate informed consent. The immediate potential complications of structural fat grafting are related to surgery itself. Late complications are primarily aesthetic.

Although the cannulas used are blunt, damage to underlying structures (nerves, blood vessels, muscles, and glands) is possible. The most devastating is the rare complication of intravascular emboli [33]. However, cannulation of a vessel and permanent nerve injury have never been reported using a blunt cannula.

Bacterial contamination of the fatty tissue can result in infection and resorption of the grafted tissue. Meticulous sterile technique must be observed with careful attention to preoperative patient preparation with antiseptic soaps and an antiseptic agent such as povidone iodine.

Fat grafting appears to be stable after placement in most situations. However, during the procedure and in the immediate postoperative period, care should be taken to avoid migrations of the fatty tissue into the surrounding tissues. Forcing too much fatty tissue into any area may cause the fat to move into another area. Placement of fat grafts into areas of significant intrinsic facial muscle motion, such as the lateral corrugators, may precipitate migration from the area of placement. In addition, after transplantation, fat has the potential to increase or decrease in size especially related to weight gain or loss.

Most patients find it desirable to remove fat and contour the rest of the body at the same time as fat grafting. However, a potential complication with this technique is the creation of donor site deformities or problems with incisions. Even the surgeon who is facile at liposuction may create donor site deformities. This is not a complete list of complications, and more exhaustive descriptions of potential complications [38] and untoward effects are available.

Patients

Patient 1

This 42-year-old presented after a face-lift and endoscopic forehead lift (without any eyelid procedures) 2 years previously. After the procedures, she noticed hollowing of her periorbital region (Fig. 2A, C, E). Over a year before, a physician attempted placement of Restylane (Q-Med, Uppsala, Sweden) into her upper and lower eyelids, but the patient noted lumps and a bluish discoloration in the areas of injection.

Fat was placed at one procedure in the following amounts: right temple 4 cc; left temple 5 cc; frontal forehead 4 cc; upper eyelids 1.5 cc each side; right anterior malar fold 1.5 cc; left anterior malar fold 2 cc; right infraorbital rim 2.5 cc; left infraorbital rim 3 cc; lateral eyelid 0.8 cc each side; and each anterior malar region 1.5 cc. Into selected specific wrinkles of the forehead, 2.7 cc was placed using a 22-gauge needle for intradermal placement.

The patient returned at 10 months with subtle, but remarkable changes (Fig. 2B, D, F). She had no topical treatments or change in skin care. The primary change noted was in the quality of her skin with filling of the anterior malar folds (tear trough) and ablation of the wrinkles in her lower eyelids and crows' feet. The pores of the forehead and the anterior malar region were beginning to line up into wrinkles in the before photos, but have become smaller and less linear in the after photos. There is a correction of the hollowing of the upper and lower eyelids, with less upper eyelid showing and an apparent elevation of the eyebrows. The temples area slightly expanded, which allows more visualization of the brow from the front view.

Patient 2

This 48-year-old presented asking for larger lips (Fig. 3A). The following volumes were placed in one procedure: body of the upper lip 2 cc; white roll 1 cc; philtrum 0.75 cc; body of the lower lip 6 cc; marionette grooves 1.8 cc each; nasolabial folds 4 cc on right and 3 cc on left. She returned 2 years after the one procedure (Fig. 3B).

Patient 3

This 22-year-old presented for lip augmentation (Fig. 4A). She had 3.5 cc of fat infiltrated into the body of her upper lip and 5.5 into the body of her lower lip with a blunt cannula. Using a 22-gauge needle, 1 cc was placed into the deep vermillion along the white roll and another 1 cc along the rim of the lower lip. One year after the one procedure the patient returned (Fig. 4B).

Patient 4

This 33-year-old presented complaining of having "no chin and a weak jaw," which he felt made him "look weak and unattractive" (Fig. 5A, B, C). He had a chin implant 8 years earlier and buccal fat

Fig. 2. (*A, B, C*) This 42-year-old presented complaining of hollowing of her eyelids after a face-lift and forehead lift. (*D, E, F*) Ten months after diffuse placement over the temples, upper and lower eyelids, the patient returns with remarkable rejuvenation. The quality of her skin is enhanced with lightening of the lower eyelid skin, ablation of most wrinkles, and a decrease in the size of pores over infiltrated areas. She has a restoration of the fullness of her brow with a youthful decrease in upper eyelid show and an apparent elevation in the position of her eyebrows.

removal 3 years earlier. Along the posterior border, 18 cc of refined fat was placed on the right and 19 cc on the left, both feathering up over the masseter; 8 cc was placed along each anterior border of the mandible feathering up to the lateral chin; and 16 cc was placed over the lower body of the chin. Finally, 6.5 c was suctioned from the right jowl area and 1.5 cc from the left. He returned 1.5 years later pleased with his results, but asking for reduction of the submental region; 11.4 cc was suctioned. He had a more athletic and healthier appearance when he returned 2 years after the submental suctioning and 3.5 years after the only fat grafting to the jawline (Fig. 5D, E, F).

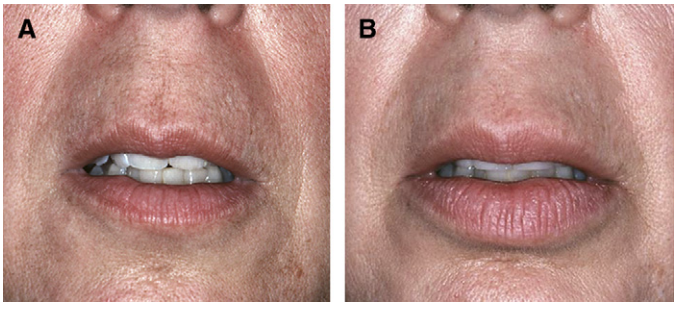

Fig. 3. (*A*) Before and (*B*) two years after one infiltration to the upper and lower lip for rejuvenation and enhancement. Note diminution of wrinkles along the white roll up into the cutaneous lip along with the expansion of the lip to create more vermilion show.

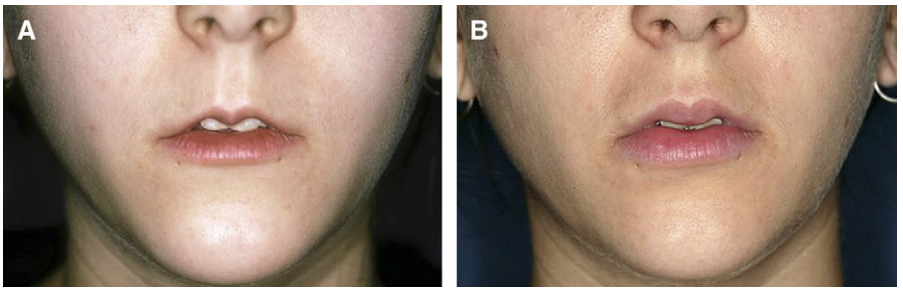

Fig. 4. (*A, B*) This 22-year-old returned 1 year after one procedure to her upper and lower lips. Please note the attempt to maintain the central cleft of the lower lip while attaining central eversion.

Results of facial rejuvenation using fat grafting

These patients illustrate that a full and structured periorbital region, voluptuous lips, and a strong, healthy appearing mandibular border project health and well-being. By using this technique consistently, I have observed that the result from fat grafted by this technique seems to stabilize at about 4 to 5 months. Although a large portion of the structurally grafted fat appears to remain after grafting, research quantifying the percentage of survival with this particular method is needed to demonstrate accurately the percentage of survival.

The goal in facial rejuvenation should include the following: to restore a youthful fullness to the upper face; to sculpt an angular but full cheek that flows into a full lower eyelid; and to create an attractive, straight shadow under the mandible with a well-shaped chin.

Adding support to the midface and lower eyelids rather than excising and suspending structures results in a much more natural rejuvenation and enhancement. The cheek, both malar and buccal areas, is relatively easy area to visualize in 3 dimensions. The results of cheek augmentation with fat are the most what-you-see-is-what-you-get at the end of the procedure of any area in the face and body [39]. I recommend this area for learning 3-dimensional manipulation of the face.

On the other hand, the lower eyelid is one of the most difficult areas for structural fat grafting [39]. Areas of excess fullness and even irregularities or small lumps can be visible through the skin when the swelling resolves. The lower eyelid is not an area to first learn transplanting fat, but should be done when the surgeon has performed enough grafting in other areas to approach the lower eyelid with confidence in the technique.

The upper one third of the face is the least understood area of the face. Although much easier technically to approach than the lower eyelid, the temples and brow require a complete re-thinking of the area to rejuvenate [40,41] (Fig. 2). We have misidentified many of the problems of aging in the upper eyelid, brow, and temple, and excision and suspension procedures do not always work in this area to rejuvenate, and often make the patient look old or sick.

Changing structure of the lips as in Figs. 3 and 4, is a relatively simple procedure, but often poorly understood by surgeons and patients. The process of aging in the lip and the mechanisms for restoring or creating structures in the lip entails not only an intimate knowledge of the subtle curvatures in a youthful, attractive lip, but also the differences between the shape and size of the upper and lower lips [42,43]. A youthful aesthetic upper lip has a distinctly protuberant and continuous full white roll that tapers off from peaks on either side of the Cupid's bow and becomes less obvious laterally. Cephalic to the white roll, the skin curves into a slight concave. The two distinct philtral columns ascend in a similar concave fashion from their origin at the peaks of the Cupid's bow to the columella. Under the Cupid's bow, the vermillion of the lip has a well-centered, distinct tubercle, which is the most caudal element of an attractive upper lip. The width of a lip comes from the most lateral fullness, which is significantly less protuberant than the central tubercle in the vermilion. Between the central tubercle and the lateral fullness is often a concavity or slight depression.

The lower lip has a slightly protuberant rim, which is less distinctive than the white roll of the upper lip. The fullness and depressions of an attractive lower lip complement the upper lip following the shape with opposing components. A distinct central cleft is bordered on either side by oblong protuberances significantly larger than any of the elements of the upper lip. The alignment of the oblong lower lip tubercles is oblique in a fashion that pushes the most central lip out into a distinct pout. The amount of vermilion visible is much greater in a normal, youthful lower lip than in an upper lip.

Fig. 5. (*A, B, C*) This 33-year-old presented complaining of having "no chin and a weak jaw." He had a chin implant 8 years earlier and buccal fat removal 3 years earlier. Along the posterior border, 18 cc was placed on the right and 19 cc on the left; 8 cc was placed along the anterior border of the mandible on each side feathering up into the lateral chin; and 16 cc was placed over the lower body of the chin. Finally, 6.5 c was suctioned from the right jowl area and 1.5 from the left. He returned 1.5 years later pleased with his results, but asking for reduction of the submental region; 11.4 cc was suctioned. He had a much more athletic and healthier appearance when he returned 2 years after the submental suctioning and three and a half years after the only fat grafting to the jawline (*D, E, F*).

The lip is not a trough or hole that the surgeon can just fill; instead, he or she must visualize a 3-dimensional structure and sculpt in free form. To attain consistent results with lip enhancement, a well-thought-out strategy that aims at a specific shape for the lip should be devised for every patient. However, the lips are not clay to be molded; they are living flesh with many variables that are difficult to predict: swelling, bleeding, scarring, and so forth.

Strengthening a weak mandibular border as in Fig. 5 creates not only a healthier appearance, but also a stronger more youthful presence. Placement needs to be at many levels from the periosteum to the skin [44].

Discussion

Fat harvested, refined, and placed in the fashion described here has many qualities that make it appropriate to consider by surgeons as the best choice for a soft tissue filler. It is biocompatible, natural, and stable.

The most important concern a surgeon should have of a soft tissue filler is that it should not endanger the health of the patient into whom it is placed. A patient's own fatty tissue, which has not been contaminated by the addition of other substances or microbes, should be nontoxic to the patient and local tissues. Fat appears also to be relatively resistant to infection after implantation, like any living tissue.

Fat infiltrated in the fashion described here can be nondetectable as a separate entity after placement and blend completely naturally into the host tissues. This is because fat has the potential to become completely integrated as living tissue after injection. Although a volume correction from structural fat augmentation is usually obvious on photographic comparison, the changes in structural fat grafts appear and feel natural. Many soft tissue implants can only be placed next to bone or deep in muscle, but become obvious as a separate entity with superficial placement. Likewise, some injectable fillers are approved only for dermal injections. Structural fat can be placed superficially and deeply into most levels of the face.

Harvesting and refinement

Fat is fragile tissue that may not survive the trauma of harvesting, refinement, transfer, and insertion into a donor site. Each step has the potential to injure the fat cell or destroy the fatty tissue architecture. The survival of free grafts of most human tissue (skin, bone, cartilage, cornea, and so forth) requires maintenance of tissue architecture, not just the transplantation of cells. The most important consideration for harvesting and refinement in preparation for grafting is to respect and maintain the tissue architecture of living fat. Any mechanical or chemical insult that damages the fragile tissue architecture of fat will result in eventual necrosis of the injected fat.

Fat should be harvested as an intact parcel already a size that can easily pass through the lumen of the small infiltration cannula to allow placement. The mechanical activities used to reduce large parcel sizes to allow passage through a smaller needle (straining, chopping, beating, washing) potentially fatally disrupt the fragile tissue architecture. For predictable results, the surgeon should refine the fat into relatively pure living tissue. Transplanting a high percentage of nonviable components (oil, blood, local) reduces the potential for accurate volume estimation.

Placement

The transplanted fat must have access to a blood supply. This technique emphasizes integrated placement of fat with fat parcel separated from each other and the host tissue in between. This places each parcel in maximal contact with vascularized host tissues rather than other pieces of fat. It also encourages anchoring of the fat parcels to the host tissue, which discourages migration in the immediate postoperative period. Placement in this manner allows integration of the transplanted tissue into the host tissue so that the fat is not palpable as a discrete entity.

Using this technique, the fat should be grafted so that the desired shapes are formed during the infiltration of the fat. Because the fat is integrated into the host tissue using this technique, attempts at significant molding of the fat after placement are usually futile and can cause undesirable irregularities.

Volumes of placement

The key to accurate volume placement is familiarity with the technique, knowledge of attractive facial topography, and understanding the goals of the patient. A surgeon must understand facial proportion and the manner that fullness is lost with age.

With experience, the surgeon comes to expect what 5 mL of refined fat will do when placed in the cheek, lower eyelid, lip, or chin. However, even with a preconceived idea of the amount to place in any area, the shape and size of the area immediately after grafting is an important clue for determining the volume and placement of fat.

Unfortunately, many variables can alter the appearance immediately after grafting. The edema caused by forcing a blunt cannula repeatedly through the tissue can be different from person to person as well as area to area. A hematoma or even excessive bruising can mislead the surgeon. In areas of strong facial muscle movement (mouth, glabela), motion may play a role in some patients in forcing the infiltrated fat out of the area of placement in the immediate postoperative period. Not only are there many local factors that influence the ability of fat grafts to enact certain corrections by a volume placed, but also there are genetic, dietary, pharmaceutical, and other factors yet to be determined.

Levels for placement

Surgeons sculpting the face with autologous fat must address the many different levels, anatomical compartments, and structures such as bone, muscle, fascia, major salivary glands, nerves, blood vessels, and skin. I have described in the past placement of fat at all levels from the periosteum, perichondrium, or mucosa to the subdermis or vermilion. However, I now avoid placement of fat into facial muscles in most situations as it creates superficial edema, which deceives a surgeon into believing that a correction has been attained. For instance, placement of fat into the obicularis oris will create submucosal and subvermillion swelling that will evert the lip. However, as the superficial swelling subsides from under the mucosa and vermillion, the lip inverts. This leaves a thicker muscle in the lip without the correction afforded by the eversion of the vermillion and mucosa. Therefore, in a front photograph, the lip will not appear to have increased in size because it is no longer everted even though the fat has survived. Instead, in a profile view the lips will project away from the face in an unnatural fashion.

Intradermal placement

I have specifically discouraged intradermal placement in the past [45]; however, in the past 3 years as I began to use hyaluronic acid in my practice, I became reacquainted with the advantages of intradermal augmentation. With that in mind, for scars and deep wrinkles, I now use a sharp 22-gauge needle to place small amounts of fat into the deep dermis to complement the subcutaneous placement. Forcing large parcels of fat through a needle is technically awkward, and the needles block frequently. Particular care should be paid to avoiding placement that is isolated since such corrections may result in circumscribed, visible corrections. The long-term effect of this method of placement does not appear to be as reliable as with subcutaneous placement with a larger bore cannula. However, I have observed significant correction for 2 years in some patients; furthermore, the effect of intradermal placement of fat is different from the effect of placement of the same volume into deeper subcutaneous planes. With intradermal placement, wrinkles can be softened or even ablated with minimal volume. Scars can be improved or eliminated that would not be as affected by simple subcutaneous placement.

Release of adhesions

This intradermal technique of fat placement is specifically different from the technique of injection with a sharp needle into a subcutaneous plane described by Carraway and Mellow [13]. They described the use of small sharp needles to undermine before placement with the needle. This may create a potential space that can destabilize the placement of fat and encourage migration and irregularities. Therefore, I do not recommend undermining before injection. If adhesions, scars, or ligaments are still present after the initial placement of fat subcutaneously and intradermally, it may be necessary to release them with a "v-dissector" or sharp needle in a "subcision" fashion [46]. In these instances, the sharp instrument is used to disrupt a connection from the dermis to the underlying anatomic structures. This type of maneuver is traumatic and may allow the placed fat to migrate. Such destabilizing approaches should be used with caution and should be delayed until after intradermal and subcutaneous placement is substantially completed.

Research

Fat grafting is technique dependent, and not all techniques, surgeons, and patients will experience the same longevity or effect of grafted fat. One of the current problems with analysis of the results of fat grafting is that there has been never been a standardization of the methods of fat grafting used. Radically different techniques are often used in both research and in clinical practices, which makes extrapolation of the result of studies or anecdotal experiences to other situations difficult. In addition, remarkable ranges of the results have been noted from one human to another and between different anatomical sites even when using exactly the same technique and volumes [47]. Surgeons should try to identify the techniques, patients, and anatomic regions that encourage long-term survival and reliable results with grafted fatty tissue.

Summary

The outcome of grafting fat is dependent upon variations in the technique used to harvest, refine, transfer, and place fat as well as the avoidance of complications. In addition, the effects of grafted fat differ between recipient sites and even from patient to patient. Because of this variability and perhaps because of other factors not understood, the results of fat grafting with some techniques, in some patients, and in some areas can be unpredictable. Directed research will help us to understand better the differences between different techniques, surgeons, and patients for this valuable technique and to elucidate the methods and situations that will provide surgeons with the most consistent results.

Fat grafting through a blunt cannula has been used by plastic surgeons for altering facial contours

for almost 100 years. Autologous tissue is completely biocompatible, and therefore is usually the safest choice for altering facial volume or contours. Furthermore, fat grafts can be placed in such a fashion that they are long lasting, completely integrated, and natural appearing. However, only in the past 20 years have advances in techniques and instrumentation allowed us to obtain predictable results that make fat grafting a viable option for soft tissue augmentation. Concurrent with the development of fat grafting, our understanding of aging and methods of rejuvenation have developed also. We now approach rejuvenation and adjustment of facial proportion with a better understanding of the need for the restoration or adjustment of facial volume.

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