Long-overlooked, volumizing is a critical factor in facial rejuvenation. Here’s why and how to use autologous fat to obtain better cosmetic results.

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Without argument, in the search for a substance that fulfills the criteria of an ideal filler, fat wins. Autologous fat is non-immunogenic, available in relative abundance, is a living tissue, and easily conforms to the properties of the area into which it is injected. Despite these obvious benefits, since first performed more than 100 years ago, fat transplantation has had a checkered history. As with all cosmetic surgery procedures—which come into vogue then with a swing of the pendulum, quickly lose status in favor of older, more time-tested procedures—fat transplantation has been alternately embraced and generally abandoned. Soon after its emergence, it was quickly replaced with “lifting” and “tightening” surgeries. However, surgeons now realize that all our traditional “lifting” procedures, such as facelifts, eyelifts, and browlifts, have achieved a “tighter” and “lifted” appearance for our patients rather than truly achieving a rejuvenated look.

Autologous fat transplantation, when properly performed, can achieve long-lasting, natural-looking rejuvenation that satisfies patients and physicians. Key to good results is proper technique and patient management, using the systematic approach below.

Learning from History
In a study that critically evaluates the long-term results of his deep-plane rhytidectomy, Hamra elegantly demonstrates the point that “lifting” or “tightening” does not equal “rejuvenation.” He found that while he was able to achieve short-term improvement of the nasolabial folds, these results diminished considerably after a few years. Furthermore, critical analysis of patients showed that the deep-plane facelift failed to achieve shortening of the vertical height of the periorbital region. His study highlights the importance of critical analysis of one’s surgical results.

Anyone who has attended recent dermatologic surgery, cosmetic surgery, and plastic surgery meetings can see the renewed focus on volume restoration as an integral part of facial rejuvenation. By better understanding the mechanisms by which the face ages, we better appreciate the importance of volume. However, this renewed interest has also revived some of the controversies that plague fat augmentation.

Considering the advantages described above, it is surprising to see that fat transplantation remains such a hotly debated subject. Academic meetings and peer-reviewed articles are replete with examples of the debate that ensues regarding the long-term survival of fat grafts. Review of the studies makes it clear that there are numerous techniques being used to harvest, prepare, and inject fat grafts. Therefore, it is should come as no surprise that results vary from surgeon to surgeon. However, it seems that there are similarities between the techniques that seem to yield the best longevity of the
grafts. These similarities will be the focus of this article; I'll present the technique used in over 250 patients over the past five years.

**Facial Volume Loss**

The aging face shows characteristic changes that in the past were solely attributed to the effects of gravity on skin, muscle, and fat. Designing surgical procedures with this in mind led to the development of various rhytidectomies and browlifts. The fact that patients did indeed look tighter and “lifted” but not necessarily rejuvenated indicates that ptosis remains only one of a multitude of changes that contribute to the stigmata of the aging face.

Several well-designed studies that detail the bony changes that take place with aging must be taken into consideration when planning aesthetic procedures. A computer-assisted tomography study has shown that the lower midfacial skeleton becomes retrusive with age relative to the upper face. Maxillary retrusion is a probable factor in the development of the nasolabial fold as it occurs at a point below the nasolabial fold. The loss of bone volume in this area also allows for the downward displacement of the soft tissues, thus accentuating the nasojugal fold and the malar mound.

Another excellent study of the midface showed that the prominence of the nasolabial fold is due to a combined effect of ptosis and fat/skin hypertrophy. The authors used magnetic resonance imaging technology to evaluate the mid-cheek/nasolabial fold in younger versus older women. The authors observed that thickness of the upper portion of the fat pad did not decrease while thickness of the midportion of the fat pad increased indicating that both a redistribution of the cheek fat (ptosis) and increased volume of the fat (hypertrophy) may contribute to deepening of the nasolabial fold in older subjects.

In addition to the bony and soft-tissue changes mentioned above, volume distribution changes take place as the aging process continues. Surgeons that perform a great deal of volume restoration surgeries have offered insight into the morphologic changes that take place over the years. Donofrio describes the three-dimensional young face as defined by three primary arcs:

1) lateral cheek projection from the tarsus down to the lower face,
2) along the jawline on each side from the lateral mandible to the mentum, and
3) on the forehead and continuing into the convexity of the brow. There are a number of secondary arcs as well.
In contrast, the aging face shows dramatic demarcation of the various cosmetic subunits. The primary arcs now become disrupted and replaced with “broken, wavy, or concave” shapes. Loss of volume in these regions creates a relative excess of skin. Additionally, Donofrio mentions a distinct subset of older patients that develop hypertrophy of the fat in certain regions of the face: submental, jowl, lateral nasobial fold, lateral labiomental crease, and the lateral malar areas. In these patients, she advocates liposuction while lipofilling the atrophied areas.

Coleman suggests that the aging face begins to show more fat in the jowls, above the nasobial folds, and in the eyelids as the surrounding fullness disappears. In addition, the bony skull becomes more noticeable in certain areas as volume is lost.

It becomes obvious that one must incorporate these hard- and soft-tissue changes into our cosmetic surgery procedures to truly achieve a youthful appearance for our patients.

**Harvesting Techniques**

Select the most accessible donor site, harvesting the fat while being careful not to cause an iatrogenic defect at the donor site. Occasionally, in thinner individuals, it is necessary to use several donor sites to harvest an adequate amount of fat.

To achieve anesthesia of the donor site, use a modified Klein’s solution: 0.2% lidocaine with epinephrine 1:500,000. However, rather than tumescent anesthesia of an area, a wet technique is used. Approximately 120cc to 200cc is infiltrated into the tissue using 20-gauge spinal needles or a blunt-tip infiltrating cannula. Usually, 1-3cc of anesthetic is used for each 1cc of fat to be aspirated. To allow proper analgesia and vasoconstriction, allow the solution to take effect for five to 10 minutes.

Using manual syringe suction to harvest fat minimizes trauma to the adipocytes that may occur with machine suction. The plunger of a 10cc syringe is withdrawn 1-2cc during the aspiration of the fat to create the necessary suction. A Coleman 3mm harvesting cannula (Byron Medical, Inc.) is used (Fig.1).

Since the use of the modified Klein’s solution is hypo-oncotic, the harvested fat will have 1.1-1.2g% protein (normal is 2-4g%). Therefore, 1cc of 25% human albumin is placed in the 10cc syringe prior to harvesting the fat. Albumin not only normalizes oncotic pressure, it acts to further condense the harvested adipocytes by allowing for greater fluid removal from the cells.

**Fat Processing**

The 10cc syringes of fat are then capped and centrifuged in a sterile fashion at 3100 rpms for one minute. Centrifugation results in three layers in the 10cc syringe: infranatant (fluid, blood), middle layer (fat), and supranatant (triglycerides, oil) (Fig.2). Decant the infranatant and supranatant, and transfer the remaining fat to 1cc syringes.

**Fat Infiltration Techniques**

Obtain consent, then photograph and mark the patient in an upright position. While an assistant prepares the harvested fat, the surgeon can anesthetize the face using a combination of nerve blocks (1% lidocaine with epinephrine) and some of the tumescent anesthetic solution to reach the areas missed with nerve blocks. An assistant holds pressure after each injection to minimize bruising.

A zygomatic arch incision made with a 16 gauge No-Kor needle (Becton Dickinson) permits access to most of the midface and temples. At the conclusion of the procedure, close all with a single suture using 6.0 fast absorbing gut suture.
Fat Transfer

The 1cc syringes of fat are infiltrated into different levels by using most commonly a Coleman #2 cannula (Fig. 3). Take care to infiltrate only 0.05-0.1cc of fat per parcel. This keeps as much of the surface area as possible of the adipocytes in contact with the surrounding tissue from which they must draw nutrition until they reestablish their vascular supply. Fat grafts are placed subcutaneously, intramuscularly, and submucosally.

While practically any area of the face can be augmented there are a few considerations based on anatomic site. The nasojugal crease and temples are the sites most prone to postoperative “lumpiness” or visible fat grafts. In contrast, the perioral region is the area most likely to lose a larger percentage of the grafted fat due to the high mobility of this area that comes with smiling, chewing, and talking.

Repeat Procedures

Preoperatively, during consultation, inform patients that they may require more than one fat grafting procedure. This is especially true for patients with thinner faces or patients over 60 years of age. Usually, the final result is evident by three months. Therefore, sessions are spaced no sooner than three months apart so that the final result of each session is appreciated prior to the addition of more fat. Figures 4-5 show typical before and after results for patient across a wide age range.

Complications

As with any surgical procedure, the main concern is infection prevention. Ensuring sterility during the entire harvesting, preparation, and infiltration of the fat tremendously reduces this risk. I have encountered only one infection in over 250 cases; it responded appropriately to systemic antibiotics. I do not routinely prescribe prophylactic antibiotics. The literature supports the low incidence of infection in fat augmentation patients. However, there is a report of a patient developing an infection with *Mycobacteria xenopi* from a possible dental abscess.1

I have also reported on a case of dacryocystitis that followed the placement of punctal plugs in a patient with an undiagnosed lacrimal duct obstruction.2 The timing of the plug placement and the development of the infection occurred three days after the fat augmentation surgery, thus making the diagnosis of dacryocystitis more difficult.

There have been several reports in the literature of fat embolization secondary to inadvertent intravascular injection of the fat.3-5 To reduce the risk of intravascular injection, I recommend the use of only blunt-tipped instruments. Furthermore, to reduce the pressure needed to inject the fat, clinicians should only use1cc syringes. A further safeguard against intravascular injections includes the use of epinephrine in both the nerve blocks and in the local anesthetic to promote vasoconstriction.

While not a “true” complication, weight loss of over 10 pounds results in a loss of the facial augmentation. Patients who wish to lose weight are encouraged to do so prior to fat augmentation. I have had several patients that initially showed excellent results after surgery only to lose the volume by subsequent dieting. On the other hand, moderate weight gain can result in hypertrophy of the grafted fat.6-8 The hypertrophy may be sufficient to require intervention.

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Breaking History’s Cycle

The field of autologous fat augmentation is an exciting and expanding one. At our institution, we are currently in the middle of research to help evaluate the longevity of the fat grafts in vivo. Other researchers are looking into using preadipocyte cells (stem cells) to enhance the results of fat augmentation in both cosmetic and reconstructive surgery. The field of stem cell research may help direct us in the proper placement of the grafts to better replicate the structure we wish to augment (muscle, fat, bone). By learning this procedure and keeping abreast of new research, we will establish its role in facial rejuvenation and go a long way to enhancing the natural results of our cosmetic surgery procedures.