The Lift-and-Fill Facelift
Superficial Musculoaponeurotic System Manipulation with Fat Compartment Augmentation

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KEYWORDS

• Facelift • Rhytidectomy • Fat compartments • SMAS plication • SMAS stacking

KEY POINTS

- Current facelift techniques have shifted from the single focus of superficial musculoaponeurotic system (SMAS) alteration to volume restoration and facial recontouring.
- The deep malar (medial) compartment and nasolabial fold are always fat grafted first, whereas the high lateral (superficial) compartment is augmented last.
- SMAS stacking is typically indicated for facial sides that are narrower and require more fullness.
- SMASectomy is indicated for wider and fuller faces.

INTRODUCTION

Current facelift techniques have shifted from the single focus of superficial musculoaponeurotic system (SMAS) alteration to volume restoration and facial recontouring. Although tissue mobilization and elevation remain a mainstay in facial rejuvenation, restoring volume is what allows a smooth contour and overall facial shaping. A combination of such techniques, appropriately tailored for each face, is what allows the natural and enduring result that patients request.[1,2]

The lift-and-fill facelift combines an individualized alteration of the SMAS with precise volume augmentation. It is now understood that deflation is a major component of the complex facial aging phenomenon and cannot be corrected by rhytidectomy alone. Anatomic studies have provided a topographic map of the superficial and deep facial fat compartments. Surgeons can now accurately and precisely augment areas that have undergone such deflation while the SMAS and its involved structures are selectively repositioned.[1–5]

Fill of Deep and Superficial Fat Compartments

Several studies have suggested that facial subcutaneous fat is highly compartmentalized.[3,4,6,7] In a youthful face the transition between subcutaneous compartments is smooth, whereas in aging individuals there are abrupt contour changes between these regions. An in-depth understanding of these compartments has proved invaluable for the successful correction of facial aging. Through cadaveric studies, Rohrich and Pessa[3] first revealed the superficial facial compartments[3,7] (**Fig. 1**).

Indications for specific fat compartment augmentation are based on preoperative analysis of the topographic deflation. Accurate preoperative planning of selective fat compartment grafting is the first step in the lift-and-fill facelift. The deep volumetric foundation influences the extent and type of SMAS and skin manipulation. SMAS stacking is performed

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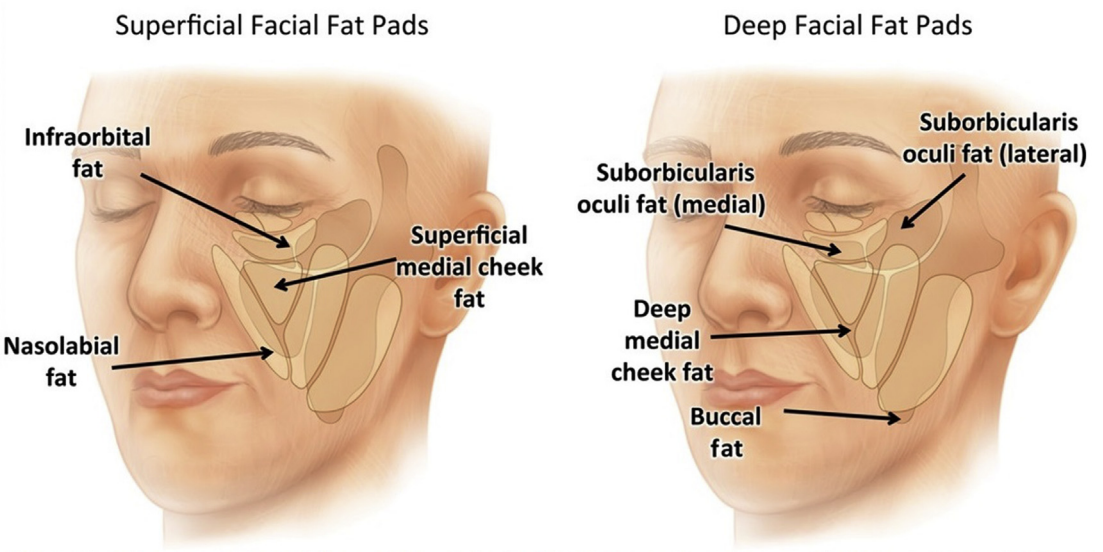

Fig. 1. Anatomy of both superficial (*left*) and deep (*right*) facial fat compartments. (*From* Pessa JE, Rohrich RJ. Facial Topography: Clinical Anatomy of the Face. St. Louis: Quality Medical Publishing; 2012; with permission.)

superficial to the augmented deeper malar fat compartments. In the setting of a fuller and/or wider facial side, where SMASectomy would be preferred, fat transfer volumes may be less indicated in the high lateral malar compartment to enhance the desired contour.[1,2,6]

An intimate relationship exists between the fat compartments and retaining ligaments of the face. Retaining ligaments are often noted to arise from areas of fascial coalescence at the junction between fat compartments. The superficial fat compartments of the face are divided by septal barriers arising from the SMAS. In the midface, these include part of the nasolabial fat and the lateral, middle, and medial cheek fat. These observations clinically correlate with those areas of fixation that are encountered when dissecting a hemiface from lateral to medial. Zones of fixation correspond with transition areas between compartments and typically have some vascular component.[3,7]

The nasolabial compartment is bordered superiorly by the orbicularis retaining ligament; the nasolabial fat compartment is distinct and can be noted medial to the deeper fat of the suborbicularis fat compartment. The lower border of the zygomaticus major muscle is adherent to this compartment. In the cheek area, there are 3 distinct fat compartments: the medial, middle, and lateral-temporal cheek fat. The medial cheek fat is found lateral to the nasolabial fold and is bordered superiorly by the orbicularis retaining ligament and the lateral orbital compartment. Inferior to the medial cheek compartment lies the jowl fat. The middle cheek fat is found anterior and superficial to the parotid gland. In its superior portion, it is partially adherent to the zygomaticus major. Where these 3 superficial compartments meet, a confluence of septa occurs and is where the zygomatic ligament is commonly described. The zone where the medial fat compartment abuts that of the middle cheek compartment corresponds with the parotidomasseteric ligaments.[3,7]

The lateral-temporal cheek compartment is the most lateral compartment of cheek fat. It lies just superficial to the parotid gland, bridging the temporal fat to the cervical subcutaneous fat. The first transition zone encountered during a facelift when advancing medially from the preauricular incision corresponds with a true septum located anterior to the lateral-temporal fat compartment.[3,7]

Although the superficial fat compartments can be manipulated by SMAS suspension to a certain extent, the deep fat of the midface is primarily altered using volume. Deep fat compartments include the deep malar (medial) compartment, middle malar, nasolabial fold, and superior cheek. The deep malar (medial) compartment lies beneath the orbicularis oculi muscle and is bounded laterally by the capsule of the buccal fat pad and the zygomaticus major muscle. The pyriform ligament surrounding the nasal base forms the medial boundary and the orbital retaining ligament its superior limit. The deep medical cheek fat was found to be supplied mainly by the infraorbital artery.[1,3,7]

Separate from nasolabial fat is the jowl fat compartment, the most inferior fat on the face. In this area, fat is adherent to the depressor anguli

oris muscle, which also makes for its medial-most boundary. Superiorly, jowl fat is bordered by nasolabial fat and medial fat, and inferiorly by the membranous fusion of the platysma muscle.[3]

The deep malar (medial) compartment and nasolabial fold are always fat grafted first, whereas the high lateral (superficial) compartment is augmented last. The deep malar compartment should be seen as the workhorse compartment in effective volume restoration[1,3,6] (**Fig. 2**). Considering that, in this area, fat lobule size is smaller and deflates at an accelerated rate, it should always be augmented first.[8] The injection of fat deep and medial to the zygomaticus major muscle significantly improves midface projection, resulting in a more youthful cheek.[1,3,6]

After adequate augmentation of the deep compartments, the surgeon can proceed to fill the more superficial areas of the face. The nasolabial fold is filled first and then the high lateral cheek can be addressed. Although this serves to accentuate malar highlights in women, it should be circumvented in men to avoid a feminizing effect.[9] Filling the middle and lateral superficial malar compartments can aid in blending the lower cheek junction and nasojugal crease.[1,3,6] In addition, perioral compartments can help augment the inferior nasolabial region and soften perioral rhytides.[10]

Fat Harvesting and Injection Technique

Various fat harvesting and preparation techniques have been discussed in the literature.[11,12] The inner thigh and abdomen have been shown to contain the highest concentration of stromal vascular cells and are of small cell size.[13] In our practice, manual low-pressure lipoaspiration of the inner thigh is accomplished using a blunt 3-mm cannula with multiple small holes. The lipoaspirate should fill approximately half of a 10-mL syringe and is placed in a centrifuge for no longer than 1 minute (2250 revolutions/min) at low pressure to remove cellular debris. The isolated middle fat should be transferred to a 1-mL syringe and promptly injected. Approximately 10 to 12 mL of yellow fat is distributed into the 2 deep central facial fat compartments. Another 10 to 20 mL is then injected in between the nasolabial compartment and lateral compartments depending on the augmentation desired. In men, the high superficial malar and middle superficial malar compartments are avoided to avoid feminization of the face.[1,4,6]

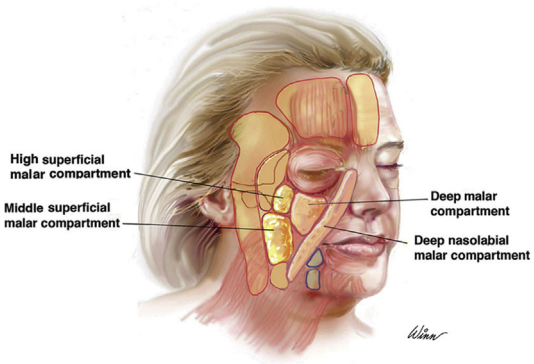

Fig. 2. Key fat compartments to be filled as part of the lift-and-fill facelift. (*From* Rohrich RJ, Ghavami A, Constantine FC, et al. Lift-and-fill face lift: integrating the fat compartments. Plast Reconstr Surg 2014;133(6):761e; with permission.)

It is recommended for fat transfer to take place at the beginning of the procedure, not only to decrease the chance of fat environmental contamination but also to allow for accurate tailoring of the SMAS over the augmented fat compartments. A 16-gauge needle is used to introduce a blunt-tipped Coleman cannula for deep compartment injection. For injection of the superficial compartments, a 21-gauge needle directly attached to the syringe can be used, which allows more precise injection and minimizes vascular trauma when injecting thicker subdermal tissue.[1,4,6]

Selective Skin Undermining

Before local anesthetic infiltration, incision placement is planned. The senior author prefers to use an intratragal incision that extends perpendicular to the preauricular incision along the infratemporal hairline anteriorly. The latter extension of the incision allows proper vertical redraping of the elevated skin flap. As with any incision in the hairline, beveling of the blade minimizes chances of alopecia. The inferior portion of the incision always extends around the base of the ear lobule and around the conchal cartilage. Incision placement in the posterior ear takes place a few millimeters above the postauricular sulcus because there is a tendency for this scar to descend as healing occurs. The incision then extends superiorly along the hairline, tailoring its length to how much skin excess is being removed.[1,2,5,9]

Once placement of the incision has been marked, the superwet technique is used for infiltration. This infiltration technique is defined as having a volume greater than 50 to 100 mL per hemiface. The solution is mixed preoperatively and consists of 30 mL of 0.5% lidocaine and 1.5 mL of epinephrine 1:1000, all mixed in 300 mL of normal saline. It is injected in the subcutaneous plane where skin flap dissection is planned using a 22-gauge spinal needle on an autofill syringe. A long spinal needle inserted only along the incision line avoids trauma to the skin flap and allows uniform hydrodissection

in a plane between the skin flap and SMAS. Hydrodissection with the superwet technique has proved particularly useful in secondary facelifts. About 90 to 120 mL of fluid is infiltrated per hemiface. The total volume injected is guided by the presence of moderate skin turgor without skin blanching. In order to maximize the vasoconstrictive effects of the epinephrine, at least 15 minutes is allowed to pass between injection time and the start of skin elevation. The incision site is reinjected before final closure.[2,14]

The senior author has always used a 2-layer approach that separates skin and SMAS layers. This approach allows bidirectional vector movement and more natural skin redraping. The level of skin undermining should be dictated by the shape and width of the patient's face. In the past, skin flap undermining usually extended medially to the nasolabial groove, which has the possibility of nasal groove effacement, oral commissure distortion, and compromising vascularity. An individualized approach serves to limit skin undermining to either the lateral canthus or just medial to the zygomaticus major muscle. In those patients with minimal skin laxity and in faces with a wide malar width, advancing the medial SMAS laterally may not be necessary and, thus, skin undermining does not need to be extensive. In contrast, patients with narrow faces that need volume recruited cephalad toward the zygomatic arch benefit from wider undermining.[2,5]

Superficial Musculoaponeurotic System and Platysma Manipulation

Skin-based techniques, although safer and possibly quicker, do not retain the same viscoelastic properties as SMAS system approaches. Procedures that allow the SMAS to bear the load of the subcutaneous mass and overall soft-tissue tension are associated with greater longevity.[5,15] It has not been clearly determined whether there is 1 specific method of SMAS manipulation that works better than other techniques. Techniques that center on SMASectomy or SMAS plication/imbrication with adequate skin undermining obviate extended SMAS dissection and can still provide excellent outcomes.[1,2,16,17]

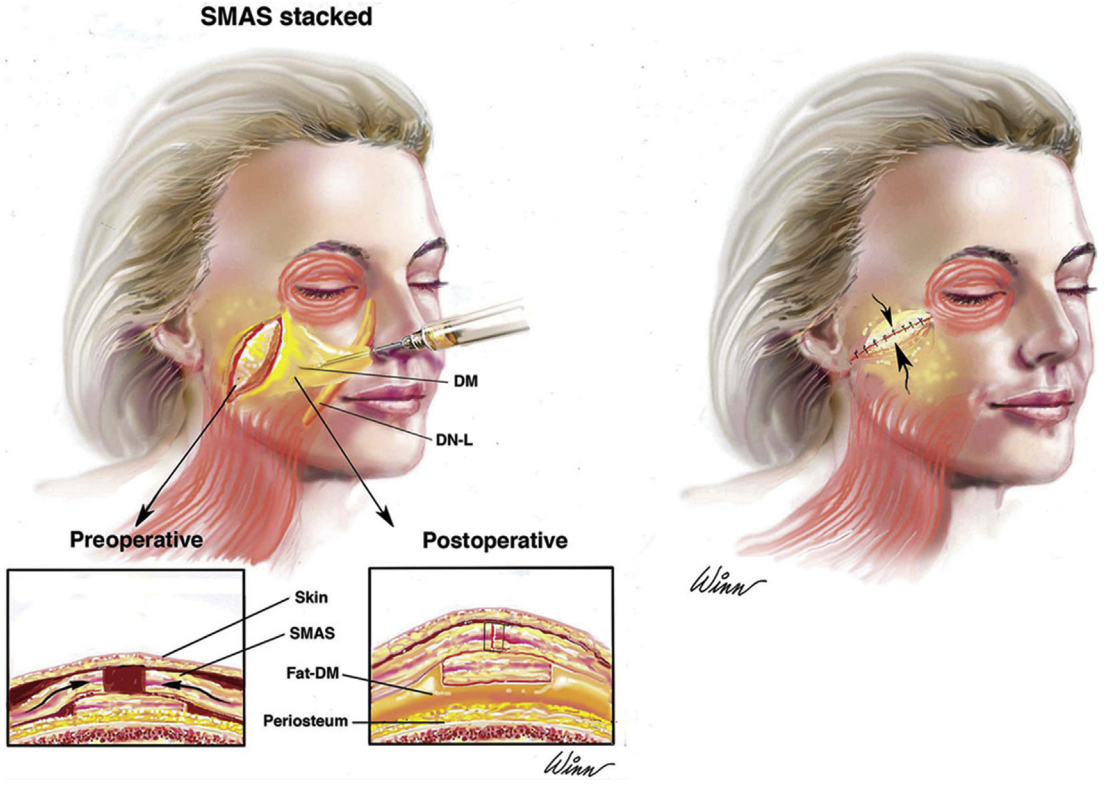

Fig. 3. In the SMAS-stacking technique, the SMAS is carefully incised, undermined proximally and distally, and then advanced toward a central axis line. When the undermined edges are brought over the remaining SMAS base, a 3-layered stacking effect results in enhanced malar projection and cheek fullness. DM, deep malar; DN-L, deep nasolabial fold. (*From* Rohrich RJ, Ghavami A, Constantine FC, et al. Lift-and-fill face lift: integrating the fat compartments. Plast Reconstr Surg 2014;133(6):761e; with permission.)

An individualized component facelift approach not only allows varying vectors of pull but also serves in better tailoring differing techniques of SMAS manipulation to each face. Preoperative evaluation of facial length and fullness dictates the orientation or angle of SMAS shaping and direction of SMAS movement. SMAS stacking is typically indicated for facial sides that are narrower and require more fullness. Such faces are in sharp contrast to those wider and fuller faces that better benefit from SMASectomy. The former not only allows enhanced augmentation in the precise topographic location that is indicated but also helps bridge the contouring effect between the deep medial and lateral superficial malar compartments.[1–6,9]

In the SMAS-stacking technique, the SMAS is carefully incised, undermined proximally and distally, and then advanced toward a central axis line. When the undermined edges are brought over the remaining SMAS base, a 3-layered stacking effect results in enhanced malar projection and cheek fullness. Stacking is a more powerful augmentative maneuver than plication because an island of SMAS is preserved centrally and a bilaminar construct is created[1–6,9] (**Fig. 3**).

The exact location of where the SMAS is incised is important because this affects where the augmentation occurs with the stacking technique. The amount of SMAS incorporated in each individual stitch bite can also serve to tailor the extent of the augmentation. Furthermore, the underlying skeletal support affects the area that is to be augmented. Patients with strong skeletal support, such as those with a greater interzygomatic width and more prominent malar eminences, may not require as much SMAS stacking over the lateral malar region. This facial shape is likely to benefit more from a horizontally directed SMAS layering or SMASectomy that mobilizes tissue in a vertical vector[1–6,9] (**Fig. 4**).

The importance of a well-defined neck contour in facial rejuvenation cannot be overstated. In patients without platysmal banding, the senior author addresses the neck using a lateral platysma window. This technique was devised in order to minimize complications during neck lifting, particularly great auricular nerve injury. Incision for the platysma window is marked anterior to the lobule at 1 fingerbreadth below the angle of the mandible and 1 fingerbreadth in front of the anterior border of the sternocleidomastoid muscle. A platysma window that is 2 cm in vertical length is performed by elevating the platysma using forceps and electrocautery. When enough of a flap has been elevated to allow good traction power, the dissection stops. It is then sutured to the posterior mastoid fascia using 2 figure-of-eight 4-0 Mersilene

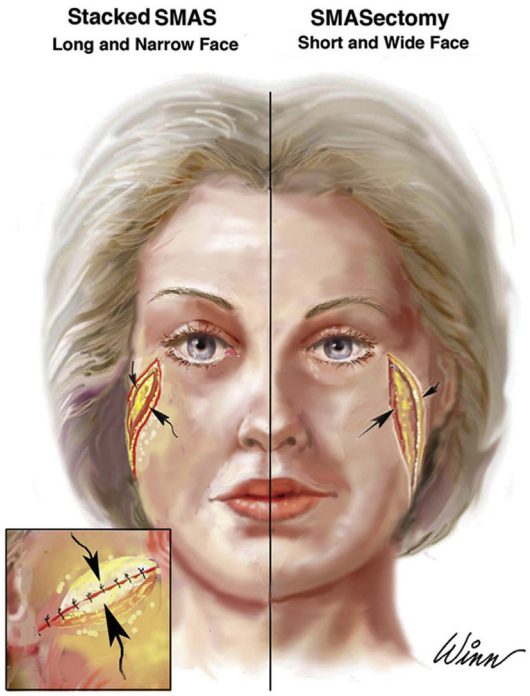

Fig. 4. Preoperative evaluation of facial length and fullness dictates the orientation or angle of SMAS shaping and direction of SMAS movement. SMAS stacking is typically indicated for facial sides that are narrower and require more fullness, whereas SMASectomy is more appropriate in fuller and/or wider facial sides. (*From* Rohrich RJ, Ghavami A, Constantine FC, et al. Lift-and-fill face lift: integrating the fat compartments. Plast Reconstr Surg 2014;133(6):762e; with permission.)

sutures (Ethicon, Inc.), spanning the area where the great auricular nerve is located.[2,5,18,19]

When platysmal banding is present, an anterior platysmaplasty is performed using a submental incision. This approach allows correction of medial platysmal laxity and also resection of subplatysmal fat under direct visualization in those select cases in which this is indicated. If a medial plastymaplasty is needed, the senior author performs this after the SMAS has been fixated. This order of events allows maximal malar elevation without having an opposing pull if the midline plication is performed first. Placement of the submental incision is planned posterior to the submental crease in order to prevent excessive deepening of the crease. Skin flap elevation in this area is done just above the platysma with most of the fat remaining attached to the skin. Wide skin undermining occurs in order to communicate with the lateral skin flaps already previously dissected. Using electrocautery, the medial borders of the platysma are defined, followed by removal of excess fat in between these. Platysmaplasty is

then performed using interrupted figure-of-eight sutures from inferior to superior. Inferiorly, the muscle is then transected transversely right above the thyroid cartilage, accentuating the cervicomental angle.[2,5,18,19]

Platelet-rich plasma is used by the senior author before closure of the skin incision in order to decrease postoperative bruising, swelling, and total drain output.[20] While the patient is being prepped, venous blood is drawn with a 60-mL syringe containing 6 mL of anticoagulant and centrifuged. A 10-mL dual-port sprayer syringe is used to draw up the platelet-rich plasma. It is then sprayed in between the skin flap and the underlying SMAS.[1,2,9,20] In an effort to reduce intraoperative bleeding and postoperative hematoma, the senior author now uses tranexamic acid both topically and intravenously. Its antifibrinolytic effect has been extensively studied in other surgical specialties and now is becoming more widely adopted in plastic surgery. For topical administration, tranexamic acid is diluted to a 3% concentration in order to

Fig. 5. A 60-year-old woman after a lift-and-fill facelift combined with individualized manipulation of the SMAS. Fat transfer volumes and their locations are labeled. SMAS stacking was performed bilaterally but in a more oblique vector on the right and with more undermining to address the shorter/wider facial side. Patient also underwent medial platysmaplasty through an anterior open approach. post-op, postoperative; pre-op, preoperative. (*From* Rohrich RJ, Ghavami A, Constantine FC, et al. Lift-and-fill face lift: integrating the fat compartments. Plast Reconstr Surg 2014;133(6):763e; with permission.)

be applied directly over the wound for 3 to 5 minutes at the end of surgery. In patients in whom the surgical site is especially bloody or in those at a higher risk of postoperative bleeding (eg, male patients), 1 g of tranexamic acid is administered intravenously during surgery.[21]

DISCUSSION

It is now understood that deflation is a major component of facial aging and, thus, cannot be corrected solely by rhytidectomy. The focus of modern face-lifting has shifted from isolated SMAS manipulation to providing necessary volume restoration and facial shaping. Precise volume augmentation should not be viewed as just an adjunct to rhytidectomy but more as a crucial component in facial rejuvenation. Patients who undergo lipofilling at the time of facelift report significantly higher satisfaction compared with those undergoing a facelift alone[1,2,22] (**Fig. 5**).

Once thought of as an anatomically continuous structure, the subcutaneous fat of the face has been shown to be highly compartmentalized.[3] Septal boundaries separating facial compartments are composed of a vascularized fibrous membrane carrying an identifiable perforator supplying the skin.[3,7] The most medial of the major cheek compartments, the nasolabial fat, is separated from the upper lip fat by the nasolabial septum. Within this septum run perforator vessels from the angular artery. The most lateral fat compartment is the lateral-temporal cheek fat, and this is supplied by perforators arising from the branches of the superficial temporal artery. Medial to the lateral-temporal cheek compartment is the middle cheek fat. The middle cheek septum, which forms the medial limit of this compartment, contains perforating branches from the transverse facial artery to the overlying skin. Located in between the middle cheek fat and nasolabial fat is the medial fat compartment, supplied by perforators of the facial and infraorbital arteries.[3,7]

Although the changes that occur with facial aging are not fully understood, this is most likely a multifactorial phenomenon. The idea of retaining ligament attenuation as the sole culprit of facial aging has been disproved. In his observations of midface and periorbital aging, Lambros[23] shows that the true descent of soft tissues might not be as profound once thought, showing that the lid-cheek junction does not typically descend with age.[1,3,23] A more likely cause for facial aging is the formation of separations between the already defined fat compartments. Loss of midface fullness, particularly in the malar and submalar areas, indicates the aging face and can only be corrected with precise fat augmentation. SMAS-shaping techniques, such as stacking, can further contribute to restoring volume in the malar region in the deflated midface. This combination is so powerful that the senior author routinely uses some degree of fat compartment augmentation of the deep malar, nasolabial, and oral commissures at the time of every facelift.[1–6,10]

The lift-and-fill facelift combines precise volume augmentation with individualized alteration of the SMAS. A good understanding of facial fat compartment anatomy cannot be overemphasized. In combination with a methodical preoperative, topographic visual analysis, this allows surgeons to target the specific areas that have undergone deflation with fat grafting before selective SMAS alteration. The outcome of such individualized combination of techniques results in the successful comprehensive correction of the aging face.

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