The Boomerang Lift: A Three-Step Compartment-Based Approach to the Youthful Cheek

Jillian E. Schreiber, M.D.
Jordan Terner, M.D.
Carrie S. Stern, M.D.
Javier Beut, M.D.
Elizabeth B. Jelks, M.D.
Glenn W. Jelks, M.D.
Oren M. Tepper, M.D.

New York, N.Y.

Summary: Autologous fat grafting is an important tool for plastic surgeons treating the aging face. Malar augmentation with fat is often targeted to restore the youthful facial contour and provides support to the lower eyelid. The existence of distinct facial fat compartments suggests that a stepwise approach may be appropriate in this regard. The authors describe a three-step approach to malar augmentation using targeted deep malar fat compartmental augmentation, termed the "boomerang lift." Clinical patients undergoing autologous fat grafting for malar augmentation were injected in three distinct deep malar fat compartments: the lateral sub–orbicularis oculi fat, the medial sub–orbicularis oculi fat, and the deep medial cheek ($n = 9$). Intraoperative three-dimensional images were taken at baseline and following compartmental injections (Canfield VECTRA H1). Images were overlaid between the augmented and baseline captures, and the three-dimensional surface changes were analyzed, which represented the resulting "augmentation zone." Three-dimensional analysis demonstrated a unique pattern for the augmentation zone consistent across patients. The augmentation zone resembled a boomerang, with the short tail supporting the medial lower lid and the long tail extending laterally along the zygomatic arch. The upper border was restricted by the level of the nasojugal interface, and the lower border was defined medially by the nasolabial fold and laterally by the level of the zygomaticocutaneous ligament. Lateral and medial sub–orbicularis oculi fat injections defined the boundaries of the boomerang shape, and injection to the deep medial cheek provided maximum projection. This is the first description of deep malar augmentation zones in clinical patients. Three-dimensional surface imaging was ideal for analyzing the surface change in response to targeted facial fat grafting. The authors' technique resulted in a reproducible surface shape, which they term the boomerang lift. (*Plast. Reconstr. Surg.* 141: 910, 2018.)

Facial aging includes changes in skin quality, skin ptosis, structural changes, and loss of facial volume. Although aesthetic plastic surgery has historically focused on the former two elements, in recent years, the importance of loss of structure and deflation in the aging face has received increasing attention.[1–3] Facial volumization with autologous fat or synthetic fillers is an increasingly important tool for restoring a more youthful appearance and structural support in aesthetic and reconstructive surgery.[4–6] Autologous fat grafting has become a popular method for addressing the aging face because of its versatility, relative safety, and longevity.[7–9]

Volumetric loss in the midface has been identified as an area of particular concern, as it leads to descent of the midface and exaggeration

From the Division of Plastic and Reconstructive Surgery, Montefiore Medical Center, Albert Einstein College of Medicine.
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of facial rhytides. There is growing evidence to support the presence of distinct fat compartments within the superficial and deep layers of the face. Rohrich et al. have demonstrated the existence of such discrete fat compartments defined by fascial barriers and that restoration of a youthful appearance can be achieved by augmenting the deep fat compartment of the midface.[1,4–6,10–12]

These studies have led us to develop a clinical approach to volume augmentation of the malar region, which includes the lateral sub–orbicularis oculi fat pad, the medial sub–orbicularis oculi fat pad, and the deep medial cheek. To assess the objective soft-tissue changes related to augmentation of these three deep malar compartments, we use three-dimensional photography. This preliminary study uses three-dimensional photography to define the topographic surface changes that occur with fat grafting in the malar region, and introduces this as a new technique called the "boomerang lift" (Fig. 1).

PATIENTS AND METHODS

Patients who underwent autologous fat grafting for malar augmentation were studied with three-dimensional photography at key operative steps. Fat was harvested from the abdomen, and the injection technique was based on the recent cadaveric studies with dyed Restylane (Q-Med, Fort Lauderdale, Fla.) by Surek et al.[12] The injection technique included three malar compartments: the lateral suborbicular fat, medial suborbicular fat, and deep medial cheek as described above. All three compartments were injected by cannula from a single injection site at the intersection between a vertical line dropped from the medial limbus and a horizontal line drawn at the level of the alar rim. Injections were performed in this specific order: lateral suborbicular fat, medial suborbicular fat, and deep medial cheek.

Fig. 1. The three individual facial fat compartments targeted in the boomerang lift. The lateral suborbicular fat, medial suborbicular fat, and deep medial cheek are shown in combination. The overall shape resembles that of a boomerang, with the short tail supporting the lower lid and the long tail extending laterally along the zygomatic arch. (Original illustration copyright Liguo Liang, Medical Illustrator, Montefiore Medical Center, Bronx, N.Y.)

The amount of fat injected into the respective compartments is illustrated in Table 1. The mean volume of fat was 1.1 cc for right medial suborbicular fat, 1.1 cc for left medial suborbicular fat, 2.1 cc for right lateral suborbicular fat, 1.9 cc for left lateral suborbicular fat, 1.8 cc for right deep medial cheek, and 1.9 cc for left deep medial cheek. The range of injection was 0 to 2 cc for right medial suborbicular fat, 0 to 2 cc for left medial suborbicular fat, 1 to 5 cc for right lateral suborbicular fat, 1 to 3 cc for left lateral suborbicular fat, 1 to 4 cc for right deep medial cheek, and 1 to 4 cc for left deep medial cheek.

Three-dimensional images were taken preoperatively, intraoperatively, and postoperatively using the handheld Canfield VECTRA H1 (Canfield Scientific, Parsippany, N.J.). To generate a single three-dimensional surface model, three separate photograph captures were stitched together using VECTRA software. Preoperative three-dimensional images were taken on the day of surgery. Intraoperative three-dimensional images were taken immediately before injection following sterile draping, and after incremental injections to the individual fat compartments such that the surface change per compartment could be studied.

Three-Dimensional Facial Analysis

The stepwise surface change caused by injections to the sequential compartments was studied using Canfield VECTRA Analysis Module software. Overlays were performed intraoperatively to visualize the change in malar contour and to assess symmetry to guide surgical decision-making. Overlays were made by manually selecting facial regions unchanged by injection (forehead and nose), followed by computer recognition and alignment of the selected identical surfaces. Color maps were then generated using a 1-mm change as the lower limit and the maximum projection value (calculated by the computer) as the upper limit. A color scale is then produced that shows a spectrum of changes for each injection (Fig. 2).

Table 1. Volume of Fat Graft Injected into the Three Deep Malar Compartments

	OD MSOOF	OS MSOOF	OD LSOOF	OS LSOOF	OD DMC	OS DMC
Mean injected volume, cc	1.1	1.1	2.1	1.9	1.8	1.9
Maximum injected volume, cc	2.0	2.0	5.0	3.0	4.0	4.0
Minimum injected volume, cc	0.0	0.0	1.0	1.0	1.0	1.0

OD, right; OS, left; MSOOF, medial sub–orbicularis oculi fat; LSOOF, lateral sub–orbicularis oculi fat; DMC, deep medial cheek.

RESULTS

Targeted compartmental fat grafting into the lateral sub–orbicularis oculi fat, medial sub–orbicularis oculi fat, and deep medial cheek resulted in a surface change that resembled the shape of a boomerang, with the short tail supporting the medial lower lid, and the long tail extending laterally along the level of the zygomatic arch. (**See Figure, Supplemental Digital Content 1**, in which progression of augmentation in patient 1 is shown from the lateral sub–orbicularis oculi fat, medial sub–orbicularis oculi fat, and deep medial cheek to achieve the final boomerang shape, ***http://links.lww.com/PRS/C674***.) The upper border of the boomerang was restricted by the level of the tear trough/lid-cheek junction, and the lower border was defined medially by the nasolabial fold and laterally by the level of the zygomaticocutaneous ligament. This pattern was reliable across all patients. These boundaries were consistent with findings of the individual compartment augmentation zones described in cadaveric models by our group. Injections into the lateral and medial sub–orbicularis oculi fat defined the boundaries of the boomerang shape, whereas the injection into the deep medial cheek provided maximum projection. [**See Figure, Supplemental Digital Content 2**, in which an example (Fig. 3) of immediate postoperative color map analysis (patient 2) is shown. The colored region demonstrates the augmentation zone attributable to the boomerang lift. The *red* shows a 1-mm projection change at the perimeter, with a maximum of 3.5 mm of projection achieved in *blue*, ***http://links.lww.com/PRS/C675***.]

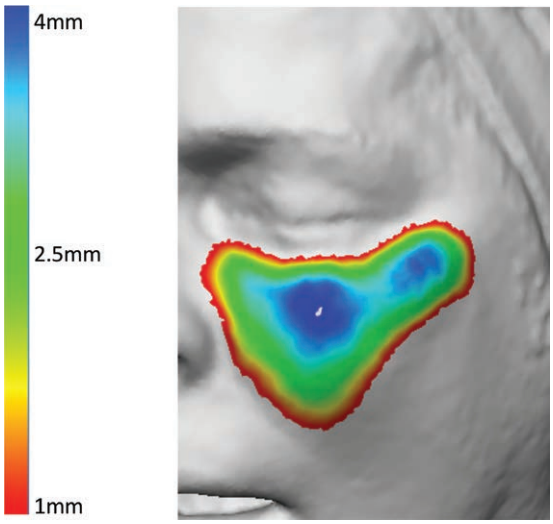

Fig. 2. Patient 1. Example of a color distribution map to demonstrate the topographic changes to the malar region caused by incremental injections into the respective compartments. (*Red* is minimum change in projection of 1 mm to maximum change of 4 mm in *blue*) Shown are the completed injections into all three compartments, the lateral suborbicular fat, the medial suborbicular fat, and the deep medial cheek. The lateral suborbicular fat and medial suborbicular fat define the overall shape, whereas the last injection into the deep medial cheek provides maximum projection across the augmentation zone. See Figure, Supplemental Digital Content 1, for the three-dimensional analysis of the individual fat compartments, ***http://links.lww.com/PRS/C674***.

DISCUSSION

This study is the first to relate volumization of the deep malar fat compartments and the distinct surface change, termed the augmentation zone. This demonstrated a reproducible pattern, which we term the boomerang lift.

Three-dimensional surface imaging enhanced analysis of the facial contour and allowed for quantifiable results. Three-dimensional technology offers novel metrics not available with traditional two-dimensional methods. Measurements of the complex facial contour, including surface area, perimeter, anteroposterior projection, and volume, can all be determined with reliable precision using three-dimensional technology. With an understanding of the three-dimensional architecture of the facial fat compartments, we were able to describe the role of three deep malar fat compartments in creating an augmentation zone that supports the lower eyelid and restores contour in facial atrophy, termed the boomerang lift (Fig. 3).

Data from our previous study suggest that patient-specific factors impact the dynamics of facial fat compartments in response to augmentation. Variables such as age, skin quality, and body mass index should be investigated further to assess their impact on the surface response to fat grafting. To generate a fat grafting algorithm where injection volume can be correlated with surface response, taking into account the above-mentioned factors, a larger sample size of patients is needed for subgroup analysis.

Fig. 3. (*Left*) Example preoperative photograph of patient 2. (*Right*) Six-month postoperative photograph following the boomerang lift (for this patient's three-dimensional analysis, **see Figure, Supplemental Digital Content 2**, ***http://links.lww.com/PRS/C675***).

CONCLUSIONS

This study, adding to the work previously performed by this group, emphasizes how fat grafting into a localized compartment specifically alters the overlying soft tissue in targeted regions. Termed the boomerang lift, this preliminary study shows how the response in patients follows cadaveric models. Future work will focus on how other fat compartments respond to volumization and how patient-specific factors may influence augmentation with fat.

Oren M. Tepper, M.D.
Division of Plastic and Reconstructive Surgery
Montefiore Medical Center
Albert Einstein College of Medicine
875 Park Avenue
New York, N.Y. 10075
orenteppermd@yahoo.com

PATIENT CONSENT

Patient provided written consent for the use of her images.

REFERENCES

1. Rohrich RJ, Pessa JE. The fat compartments of the face: Anatomy and clinical implications for cosmetic surgery. *Plast Reconstr Surg.* 2007;119:2219–2227.
2. Schaverien MV, Pessa JE, Rohrich RJ. Vascularized membranes determine the anatomical boundaries of the subcutaneous fat compartments. *Plast Reconstr Surg.* 2009;123:695–700.
3. Rohrich RJ, Pessa JE, Ristow B. The youthful cheek and the deep medial fat compartment. *Plast Reconstr Surg.* 2008;121:2107–2112.
4. Stuzin JM, Baker TJ, Gordon HL. The relationship of the superficial and deep facial fascias: Relevance to rhytidectomy and aging. *Plast Reconstr Surg.* 1992;89:441–449; discussion 450–451.
5. Little JW. Three-dimensional rejuvenation of the midface: Volumetric resculpture by malar imbrication. *Plast Reconstr Surg.* 2000;105:267–285; discussion 286–289.
6. Gierloff M, Stöhring C, Buder T, Gassling V, Açil Y, Wiltfang J. Aging changes of the midfacial fat compartments: A computed tomographic study. *Plast Reconstr Surg.* 2012;129:263–273.
7. Rohrich RJ, Pessa JE. The fat compartments of the face: Anatomy and clinical implications for cosmetic surgery. *Plast Reconstr Surg.* 2007;119:2219–2227; discussion 2228–2231.
8. Wan D, Amirlak B, Rohrich R, Davis K. The clinical importance of the fat compartments in midfacial aging. *Plast Reconstr Surg Glob Open.* 2013;1:e92.
9. Meier JD, Glasgold RA, Glasgold MJ. Autologous fat grafting: Long-term evidence of its efficacy in midfacial rejuvenation. *Arch Facial Plast Surg.* 2009;11:24–28.
10. Bucky LR, Kanchwala SK. The role of autologous fat and alternative fillers in the aging face. *Plast Reconstr Surg.* 2007;120(Suppl):89S–97S.
11. Fodor PB, Cimino WW, Watson JP, Tahernia A. Suction-assisted lipoplasty: Physics, optimization, and clinical verification. *Aesthet Surg J.* 2005;25:234–246.
12. Surek C, Beut J, Stephens R, Lamb J, Jelks G. Volumizing viaducts of the midface: Defining the Beut techniques. *Aesthet Surg J.* 2015;35:121–134.