Malar Augmentation with Pedicled Buccal Fat Pad in Orthognathic Surgery: Three-Dimensional Evaluation

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Background: Contemporary orthognathic surgery contemplates three-dimensional facial soft-tissue harmonization as one of the basic pillars in treatment planning. In particular, prominent malar regions are regarded as a sign of beauty and youth by Western societies. The aim of this article was to perform a subjective and objective three-dimensional evaluation of the pedicled buccal fat pad technique for malar augmentation in the context of orthognathic surgery.
Methods: Six consecutive patients with underlying dentofacial anomalies and bilateral malar hypoplasia were managed with simultaneous orthognathic surgery and pedicled buccal fat pad malar augmentation. Patient morbidity and satisfaction with the procedure were evaluated with a visual analogue scale. Cone-beam computed tomographic data were used to perform a volumetric analysis at 1- and 12-month follow-up by means of image superimposition.
Results: Subjective analysis revealed excellent patient satisfaction and minimal pain. Mean malar volume was 115,480.91 mm^3 preoperatively, 124,586.32 mm^3 1 month after surgery, and 119,008.77 mm^3 12 months after surgery. Thus, the final mean increase 1 year after surgery was 3527.86 mm^3 and the average amount of resorption was 5577.55 mm^3. The median variations in volume were 7.77 percent at 1-month follow-up and 3.52 percent at 12-month follow-up.
Conclusions: In conclusion, the pedicled buccal fat pad technique is a reasonable alternative for malar augmentation in the context of orthognathic surgery. The results of this preliminary report suggest that it provides satisfactory soft-tissue augmentation; avoids the use of foreign materials; and has minimal morbidity, high patient satisfaction, and adequate stability at 12-month follow-up. (*Plast. Reconstr. Surg.* 136: 1063, 2015.)
CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

The surgical creation of beauty requires the attainment of a correct balance among the three major prominences of the facial skeletal anatomy: the nose, the malar-midface, and the jawline regions.[1] Several techniques have been described to increase the volume in the malar area. The main potential complications consist of rejection or infection in the case of prosthetic implantation,[2,3] need for repeated injections of fillers, and long-term unpredictability in autologous fat injection.[4,5] In the context of orthognathic surgery, a reasonable alternative is the so-called pedicled buccal fat pad technique.[6–8]

The buccal fat pad[9] contains a rich blood supply and is rich in mesenchymal cells,[10] and its harvesting causes minimal donor-site morbidity and low complication rates.[11] Although the buccal fat

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Fig. 1. Case 6. Female patient with dentofacial deformity and malar hypoplasia. Right two-thirds view preoperatively.

Fig. 2. Case 6. Clinical result after maxillomandibular repositioning and simultaneous malar augmentation. Right two-thirds view at 1-year follow-up.

pad persists over time, its functional importance diminishes significantly with age.[12]

Since 1977 when Egyedi[13] first recommended the use of the pedicled buccal fat pad to repair oral defects, this flap has been used successfully to repair several oral,[14–17] skull base,[18] and zygomaticomaxillary defects[8]; as interpositional arthroplasty[19]; and for facial aesthetic surgery.[6,7] The aim of this article is to describe the authors' approach to malar augmentation by using the pedicled buccal fat pad in association with orthognathic surgery procedures, and to evaluate its effects and stability over time with an objective measuring protocol.

PATIENTS AND METHODS

A sample of six consecutive patients referred for orthognathic surgery and malarplasty was evaluated (Figs. 1 and 2). The Declaration of Helsinki guidelines were followed at all treatment phases, and written informed consent was obtained from all subjects.

All six patients were operated on under general anesthesia by the same surgeon (F.H.A.). Through the limited buccal incision used for the Le Fort I osteotomy,[20] gentle dissection of the buccal fat pad was performed. (**See Figure, Supplemental Digital Content 1,** which shows an intraoperative photograph of patient 2 in which the suture is engaged by a straight needle, ***http://links.lww.com/PRS/B443***.) A subperiosteal pocket was created over the anterior and lateral aspects of the malar bone. At this point, a resorbable 3-0 suture with an atraumatic needle was used to take hold of the buccal fat pad. The free end of the suture was engaged into a straight needle (Fig. 3). Subperiosteal progression of the latter allowed for displacement of the buccal fat pad toward the uppermost and lateral areas of the pocket (Fig. 4). After percutaneously recovering the needle, it was again led through the same entry port to reengage the buccal fat pad subperiosteally. (**See Figure, Supplemental Digital Content 2,** which shows an intraoperative photograph of patient 2 in which the needle is led through the same entry

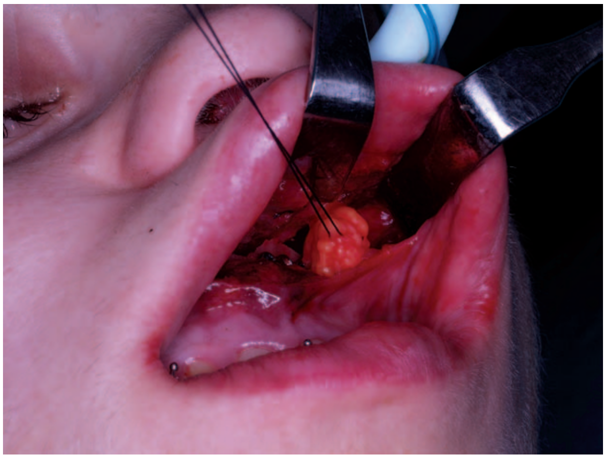


Fig. 3. Case 2. Intraoperative photograph. The buccal fat pad is held with a resorbable 3-0 suture.

Fig. 4. Case 2. Intraoperative photograph. Transposition of the buccal fat pad toward the subperiosteal pocket in the malar region.

port toward the malar pocket and engagement of the buccal fat pad subperiosteally, ***http://links.lww.com/PRS/B444***.) Finally, a triple knot secured the flap into the appropriate position. Cutaneous dimpling occasionally occurred, but it could be resolved immediately with local massage.

Subjective evaluation of the pedicled buccal fat pad procedure was performed by measuring patient postoperative pain and satisfaction with the resulting volumetric outcome. A visual analogue scale ranging from 0 to 10 was used for both variables. In the first case, 0 stood for no pain at all and 10 stood for maximum intensity of pain. In case of patient satisfaction, 0 meant complete dissatisfaction and 10 meant maximum satisfaction. Objective evaluation comprised two aspects:

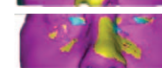
1. Complications: The following conditions were considered potential complications of the procedure: seroma, infection, buccal nerve and parotid duct injuries, asymmetries, and flap mobility.
2. Volumetric assessment: All patients underwent cone-beam computed tomographic scanning (iCAT; Imaging Sciences International, Hatfield, Pa.) at three time points: preoperatively, 1 month after surgery, and 12 months after surgery. Two postoperative time points were chosen to evaluate the short- and long-term stability of the volume-enhancing procedure.[21] Volumetric comparisons were performed by means of surface matching between different image data sets. To this effect, a specific Digital Imaging and Communications in Medicine managing software was used (SimPlant O&O version 13.0; Dentsply, Leuven, Belgium). To avoid considering false volumetric changes attributable to the orthognathic procedure itself, accurate superimposition of the cranial bones was ensured. To this effect, the cranial base and the zygomatic bones were used as reference landmarks. The volume of interest was defined as follows: first, the area within a horizontal line passing through both frontozygomatic sutures, a parallel line passing through the anterior nasal spine, and two lateral perpendicular lines, each crossing the homolateral tragus, was defined in the software. Second, the area was given a specific depth to transform it into the volume of interest. This depth corresponded to the innermost aspect of the facial skeleton. [**See Figure, Supplemental Digital Content 3,** which shows the left sagittal view of superimposed images, where blue represents the preoperative volume and postoperative volumes are represented by the purple (1 month) and yellow colors (12 months), ***http://links.lww.com/PRS/B445***. **See Figure, Supplemental Digital Content 4,** which shows the right sagittal view of superimposed images, where blue represents the preoperative volume and postoperative volumes are represented by the purple (1 month) and yellow colors (12 months), ***http://links.lww.com/PRS/B446***. **See Figure, Supplemental Digital Content 5,** which shows the frontal view of superimposed images, where blue represents the preoperative volume and postoperative volumes are represented by the purple (1 month) and yellow colors (12 months), ***http://links.lww.com/PRS/B447***. **See Figure, Supplemental Digital Content 6,** which shows the axial view of superimposed images, where blue represents the preoperative volume and postoperative volumes are represented by the purple (1 month) and yellow colors (12 months), ***http://links.lww.com/PRS/B448***.]

Statistical analysis was carried out using SPSS for Windows Version 15.0.1 (SPSS, Inc., Chicago, Ill.). Descriptive statistics was used for quantitative analysis. Each patient's percentage variation in volume was calculated as follows: [Postoperative volume × 100/Preoperative volume] − 100.

RESULTS

The studied sample included six women with a median age of 24 years (range, 20 to 47 years).

Table 1. Volumetric Analysis, Percentage Variation in Volume, and Three-Dimensional Cone-Beam Computed Tomographic Superimposed Images*

Case	Orthognathic Surgery Procedure	Malar Volume Preoperatively (mm^3)	Malar Volume at 1-Mo Follow-Up (mm^3)	Variation in Volume 1 Mo Postoperatively (%)	Malar Volume at 12-Mo Follow-Up (mm^3)	Variation in Volume 12 Mo Postoperatively (%)	Three-Dimensional Superposition Preoperatively and 1-Mo and 12-Mo Postoperatively
1	Bimaxillary osteotomy	107,581.73	116,057.08	7.88	111,441.76	3.59	
2	Bimaxillary osteotomy	91,979.06	99,023.82	7.66	94,286.85	2.51	
3	Bimaxillary osteotomy	134,827.42	142,664.85	5.81	139,489.20	3.46	
4	Bimaxillary osteotomy	115,371.87	126,393.30	9.55	119,559.92	3.63	
5	Bimaxillary osteotomy	107,154.20	108,672.96	1.42	107,732.03	0.54	
6	Bimaxillary osteotomy	135,971.21	154,705.96	13.77	141,542.91	4.09	

*Volumetric analysis (summarizes the results of the objective volumetric assessment), percentage variation in volume (summarizes the results of variation in volume [Postoperative volume × 100/Preoperative volume] − 100), and three-dimensional cone-beam computed tomographic superimposed images, where blue represents the preoperative volume and postoperative volumes are represented by the purple (1 mo) and yellow colors (12 mo).

Subjectively, all patients were satisfied with the volume achieved at the malar area (visual analogue scale score for average satisfaction = 10), and none of them complained of pain (visual analogue scale score for average pain = 1).

No surgical complications occurred in any of the cases. Table 1 summarizes the results of the objective volumetric assessment. Before surgery, the mean malar volume was 115,480.91 mm^3. The average amount of augmentation 1 month after the procedure was 124,586.32 mm^3 (median volume variation, 7.77 percent). The mean increase after 12 months was 119,008.77 mm^3 (median volume variation, 3.52 percent). Therefore, compared with the baseline volume, the final mean increase 1 year after surgery was 3527.86 mm^3.

DISCUSSION

The goal of the pedicled buccal fat pad technique is to achieve stable malar fullness and avoid the drawbacks of the conventional techniques. In addition, mobilization of this fat pad typically results in cheek hollowing and relative accentuation of the malar bone projection.

Although the small sample of our investigation hinders the possibility of drawing statistically significant conclusions, the results of the three-dimensional analysis of fat viability suggest that buccal fat pad transposition, when performed maintaining a viable pedicle, has adequate stability. According to our study, a resorption rate of −61.19 percent (median volume variation, −4.3 percent) must be expected at 12-month follow-up.

The fact that the three-dimensional evaluation protocol used in this study was based on cone-beam computed tomographic imaging studies can be justified as follows: first, cone-beam computed tomography technology has proven its validity for soft-tissue analysis in general and fat tissue in particular.[4,22] Second, cone-beam computed tomography is the state-of-the-art imaging tool for orthognathic surgery planning.[23] Third, when used in combination with the appropriate software, cone-beam computed tomographic studies allow for the superimposition of bony reference landmarks, thereby permitting soft-tissue change analysis.

CONCLUSIONS

The pedicled buccal fat pad transposition technique represents an excellent alternative for malar augmentation in patients in whom an orthognathic surgical procedure is foreseen. The standard Le Fort I approach allows for easy dissection and upper repositioning of the buccal fat pad. Subjectively, the technique is associated with minimal morbidity and high patient satisfaction. Objectively, three-dimensional analysis based on cone-beam computed tomography demonstrates adequate stability at 12-month follow-up.

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PATIENT CONSENT

Patients provided written consent for the use of their images.

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