Buccal Fat Pad Lifting: An Alternative Open Technique for Malar Augmentation

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Purpose: The purpose of the study was to introduce a novel technique for malar augmentation using buccal fat pad pedicle flaps and to evaluate the long-term results and complications of the technique.

Materials and Methods: The investigators designed and conducted a prospective clinical trial. Patients underwent unilateral malar augmentation surgery using buccal fat pad pedicle flaps from June 2011 through June 2012. Patients underwent surgery for esthetic reasons or for trauma with severely comminuted or old zygomaticomaxillary complex fractures that could not be reduced precisely. The primary predictor variable was the buccal fat pad pedicle flap technique. The primary outcome variables included the amount of augmentation and resorption (which was estimated by comparing pre- with postsurgical photographic views), pain, edema, bruising, and nerve and parotid duct injuries.

Results: Thirteen patients (8 men and 5 women) underwent malar augmentation in the cheekbone area using the buccal fat pad pedicle flap technique. One year after surgery, the average amount of resorption was 0.376 mm. Other major complications, such as prolonged bruising, massive hematoma, intense pain, asymmetry, and parotid duct injury, were not observed.

Conclusion: These results indicate that this new open-access technique should be considered an alternative method for the management of mild to moderate malar depression in patients undergoing esthetic and post-trauma surgery.

The use of autogenous free fat grafts is a well-known method to fill in superficial depressions resulting from traumatic or congenital defects. The major donor fat for this procedure is subcutaneous fat from the abdomen or buttocks. The buccal fat pad (BFP) as an anatomic element was first mentioned by Heister1 in 1732 and was described by Bichat2 in 1802. Scammon3 was the first to describe the anatomy of the BFP. In 1977, Egyedi4 was the first to report the use of the BFP as a pedicle graft; subsequently, Tideman et al5 studied its anatomic characteristics and blood supply, described the surgical technique, and presented the clinical results of 12 cases of surgical defect reconstructions of the oral cavity.

Anatomically, the BFP is an encapsulated, rounded, and biconvex, mainly adipose structure with an excellent blood supply from the maxillary, superficial temporal, and facial arteries (Fig 1).5,7 This triple irrigation system allows the use of this tissue without significant risk of necrosis. The fat pad is delimited...
by the buccinator muscle, the masseter muscle, and the ascending mandibular ramus and zygomatic arch.

The BFP flap is an axial flap and can be used to fill in small- to medium-sized soft tissue and bony defects. It is often encountered as it bulges into the surgical field during surgery in the pterygomandibular region. Use of the BFP for facial esthetic surgery was first described by Chung et al.8 and Ramirez.9 However, the literature lacks data about the technique, indications, complications, and long-term results.

The purpose of this study was to introduce a novel technique for malar augmentation using BFP pedicle flaps. The authors hypothesized that it would be effective because of its reported advantages, such as a preservation of the vascular pedicle, accessibility, and volume and that the technique should be considered an alternative technique. The specific aim of the study was to evaluate the long-term results and complications of the technique.

**Materials and Methods**

The authors designed and conducted a prospective clinical trial. Patients underwent malar augmentation surgery using BFP pedicle flaps. The study population was composed entirely of patients who were voluntarily referred to the authors’ department for the evaluation and management of malar contouring from June 2011 through June 2012. These patients had recent trauma-related comminuted or old zygomaticomaxillary complex fractures that could not be reduced precisely. To be included in the study sample, the main complaint had to be an esthetic problem, and the patients had to...
undergo unilateral malar augmentation surgery using BFP pedicle flaps with a 1-year postsurgical follow-up (Fig 2).

The following patients were excluded as study subjects: patients with orbital consequences, such as diplopia, enophthalmos, or limitations in mouth opening (as a result of severe malar bone displacement); patients unwilling to accept risks; patients requiring additional procedures, such as a zygomatic bone reduction or osteotomy; patients requiring a large amount of augmentation (>5-mm increase in malar projection compared with the control or unaffected side; Fig 2A); patients who previously underwent similar procedures; patients with compromising systemic conditions (eg, platelet dysfunction syndrome, critical thrombocytopenia, septicemia, history of local or systemic corticosteroid consumption, platelet count <100/μL, hemoglobin count <10 g/dL, and active symptoms of local infection at the site of the procedure); and patients with a history of addiction or dramatic weight loss or gain during the previous month. The primary predictor variable was the BFP pedicle flap technique. The primary outcome variables were the amount of augmentation and resorption, symmetry (which was estimated by comparing pre- with 1-month and 1-yr postsurgical photographic views; Fig 2G), pain, edema, bruising, and nerve and parotid duct injuries.

All steps of the technique were performed for all patients by a single clinician. For the evaluation of
photographic views with minimal errors, all photographs were taken in a similar fashion by 1 photographer and at the same photographic center to identify changes in the cheekbone area. To decrease the effect of postoperative edema during facial analysis, the first photographic views were obtained 1 month after the operation and the second series of photographic views was obtained 1 year after the operation.

The amount of resorption was estimated by comparing preoperative with postoperative photographic profile views, as previously described (Fig 2G). The amount of augmentation was determined by comparing the preoperative with the postoperative profile views, which were taken 1 month after the operation.

Other parameters, including permanent neurosensory deficit and intense pain, were assessed using a questionnaire modified from the extensively tested McGill Pain Inventory.

Infection, parotid duct injury, and massive hematoma also were subjectively evaluated based on clinical evaluations. This research was approved by the local institutional review board and was in compliance with the World Medical Association and the Declaration of Helsinki as it relates to medical research protocols and ethics.

Statistical evaluation of the findings was performed with SPSS 16.0 (SPSS, Inc, Chicago, IL). Parametric tests were used to evaluate treatment efficacy and complications. The significance level of statistical hypotheses was set at .05 (statistically significant).

RELEVANT ANATOMY

The BFP is an encapsulated mass of specialized fatty tissue, the volume of which varies throughout a patient’s lifetime (approximately 10 cm³). It is distinct from subcutaneous fat. It fills in deep tissue spaces and acts as a gliding pad when masticatory and mimetic muscles contract. In addition, it cushions important structures from the forces generated by muscle contraction. It is attached by 6 ligaments to the maxilla, posterior zygoma, inner and outer rims of the infraorbital fissure, temporalis tendon, and buccinator membrane. The BFP has a body and 4 processes. The body is located behind the zygomatic arch. The body is divided into anterior, intermediate, and posterior lobes in accordance with
the structure of the lobar envelopes, ligaments, and feeding vessels. The anterior lobe is located below the zygoma and extends to the front of the buccinator, maxilla, and deep space of the quadrate muscle of the upper lip and zygomaticus major muscle. The canine muscle originates from the infraorbital foramen and passes through the medial part of the anterior lobe (Fig 1).5-7,12 The parotid duct passes along the lateral surface or penetrates through the posterior part of the body fat pad before traversing the buccinator muscle and entering the oral cavity (Fig 1C to F). The anterior facial vein passes through the anteroinferior margin.

The anterior lobe also envelopes the infraorbital vessels and nerve and together enter the infraorbital canal. The branches of the facial nerve are on the outer surface of its capsule. The intermediate lobe is situated in and around the posterior lobe, lateral maxilla, and anterior lobe. It is a membrane-like structure with thin fatty tissue in adults, but it is a prominent mass in children. The posterior lobe is situated in the masticatory and adjacent spaces. It extends up to the inferior orbital fissure, surrounds the temporalis muscle, and extends down to the superior rim of the mandibular body and back to the anterior rim of the temporalis tendon and ramus. In doing so, it
forms the buccal, pterygopalatine, and temporal processes.\textsuperscript{5-7,12}

Four processes (buccal, pterygoid, superficial, and deep temporal) extend from the body into the surrounding spaces, such as the pterygomandibular space and infratemporal fossa. The BFP flap is an axial flap. The facial, transverse facial, and internal maxillary arteries and their anastomosing branches enter the fat to form a subcapsular vascular plexus.\textsuperscript{5-7,12}

\textbf{SURGICAL TECHNIQUE}

The Bichat fat pad can be extracted by 3 approaches: 1) an incision of the buccal mucosal membrane 1 cm below the opening of the parotid duct (Matarasso method), 2) an incision behind the opening of the parotid duct (Stuzin method), and 3) an incision of the superior gingivobuccal sulcus through the superomedial wall of the buccal space, which is the most common type.\textsuperscript{7} In the third approach (the authors’ preferred approach), the initial incision (a 2- to 3-cm vestibular incision from the second molar to the first premolar) spreads the mucosa, buccinator muscle, and periosteum. Limited subperiosteal dissection of zygomatic bone is performed. The Bichat fat is almost always exposed to the extent of the vestibular incision into the second molar area; if that does not occur, a small incision in the periosteum and a blunt dissection can be performed through the muscle, and the Bichat fat pad can protrude through. The capsular fascia, covering the Bichat fat pad, is maintained intact using blunt instruments, and the attached fascial layer of the wall of the buccal space is dissected off the Bichat fat pad to avoid stretching the nerve structures that cross the lateral wall of the buccal space (Fig 1). The Bichat fat pad should be free and easily movable for repositioning as a pedicle flap (Fig 2B to F). Vessels on the fascia of the Bichat fat pad usually can be observed.

In the next step, a 1-cm preorbial incision (Fig 2F) or a transconjunctival incision is planned, a subcutaneous dissection is performed in the marked malar area with scissors or cannulas, and the skin pocket is created. In the most inferior portion of the pocket, with a cut toward the bone, the skin pocket is connected to an introral incision. A 2-0 nylon suture is woven into the Bichat fat pad (Fig 2F) with a needle, and the ends of the suture are tunneled to the skin pocket (Fig 2F).
The repositioned pedicle flap is sutured to the surrounding tissues. Intra- and extraoral incisions are sutured. To evaluate the patients and the technique, a 2-dimensional facial analysis technique, which was described in the authors’ previous article, was used before the operation and at 1 year postoperatively.

Results

From June 2011 through June 2012, 13 patients (8 men and 5 women) underwent malar augmentation in the cheekbone area (10 patients with old unilateral zygomatic fracture and 3 patients with recent unilateral zygomatic bone fracture) using the BFP pedicle flap technique. In all patients, the chief complaint was an esthetic problem. No patients had ophthalmic consequences or limitation in mouth opening before surgery (Table 1).

The patients’ ages ranged from 24 to 57 years old (average age, 39 yr). Based on patients’ questionnaire responses, all patients were satisfied with the esthetic results of their surgery (Figs 3 to 6). No patient who underwent the BFP pedicle flap technique developed a permanent neurosensory deficit.
Before surgery, the average amount of under-projection in affected sites was 3.9 mm (3 to 5 mm; \( P < .05 \)). One month after surgery, the average amount of augmentation was 4.21 mm (3 to 5.5 mm; \( P < .05 \)) compared with the unaffected side, which had a value of 0.0 mm. One year after surgery, the average amount of resorption was 0.376 mm (0.0 to 0.6 mm; \( P > .05 \)) compared with the unaffected side, which had a value of 0.0 mm.

Other major complications, such as prolonged bruising, massive hematoma, intense pain, asymmetry, infection, or parotid duct injury, were not observed. A mild hollowing lateral effect to the oral commissure was observed in 1 patient (Fig 7). The total time of surgery varied from 2 hours in the first case to 1 hour in the last case. No significant difference was observed in regard to gender or age. Edema was the most frequent complication.

**Discussion**

The purpose of this study was to evaluate the BFP flap technique for malar augmentation surgery. The authors hypothesized that it would be effective because of its reported advantages, such as a preservation of the vascular pedicle, accessibility, and volume, and should be considered an alternative technique. The specific aim of the study was to evaluate the long-term results and complications of the technique. According to the facial analysis and clinical evaluation, the degree of augmentation was significant; there was no massive resorption requiring a secondary procedure. In this study, there was no case of massive edema, intense pain, prolonged bruising, parotid duct injury, or permanent neurosensory deficit. Edema was the most frequent complication.

The BFP is an encapsulated, rounded, biconvex, specialized fatty tissue that is distinct from subcutaneous fat. It is located between the buccinator muscle medially, the anterior margin of the masseter muscle, and the mandibular ramus and zygomatic arch laterally.

The volume of the BFP can change throughout a patient’s lifetime. The volume in adults ranges from 8.3 to 11.9 mL. The mean volume in men is 10.2 mL and ranges from 7.8 to 1.2 mL, whereas the mean volume in women is 8.9 mL and ranges from 7.2 to 10.8 mL. The body and buccal extension make up the bulk (50% to 70%) of the fat pad. The BFP was considered a surgical nuisance for many years because it was common to accidentally encounter the pad during various operations in the pterygomandibular area, such as for tumor, or during orthognathic or trauma surgeries.

Many articles have reported the advantages of this technique for the reconstruction of small- to medium-sized congenital or acquired soft tissue and bony defects in the oral cavity. Defects up to 12 to 15 cm\(^2\) can be closed using a BFP alone without compromising the blood supply. Rapidis et al stated that in maxillary defects larger than 4 to 4 cm\(^2\), the possibility of partial dehiscence of the flap is high because of the impaired vascularity of the stretched ends of the flap. In buccal or retromandibular defects up to 7 to 5 cm\(^2\), reconstruction can be accomplished because of the underlying rich vascular bed.

**Surgical Technique**

**Incisions**

The BFP lifting technique described in this article is an inherently open technique, and it is different from the technique of Ramirez (endoscopic midface lift) in which BFP lifting (as part of the procedure) is performed with endoscope devices that pass through the temporal hairline incisions. With the present more recent technique, 2 small incisions (intraoral and extraoral incisions) provide an open surgical field, which facilitates more precise handling. The intraoral incision can be extended beyond the midline or to the opposite side, especially in cases in which the technique is used in combination with other procedures, such as paranasal or malar implantation, orthognathic surgery, or maxillary Le Fort fracture management. In such cases, extraction of the BFP should be performed after completion of those procedures, such that the posterior extension of the flap does not extend beyond the second molar because of inadvertent fat exposure. After completing the concomitant

procedure, blunt dissection at the end point of the inner surface of the flap can expose the Bichat fat pad.

For extraoral incision, a 1-cm preorbital incision or transconjunctival incision can be used. In cases that are candidates for esthetic malar augmentation, the authors' suggestion is that surgeons use a transconjunctival incision with or without lateral canthotomy, which provides good access with an invisible scar, because scars can be an especially challenging problem for esthetics. In the present series of patients, a transconjunctival incision was used in only 1 patient, but no visible scars were observed in patients with preorbital incisions.

**BFP Extraction, Plication, and Suspension**

Precise dissection should be performed to prevent parotid duct injury. Although it is a rare complication, if transection or injury of the parotid duct occurs, then the injury is usually located at or distal to the anterior border of the masseter muscle along the line drawn from the tragus of the ear to the middle of the upper lip. Such injury should be repaired rapidly at detection during surgery. The capsular fascia covering the Bichat fat pad is maintained intact using blunt instruments, which avoids traction of the nerve structures that cross the lateral wall of the buccal space. However, injury to the distal end of the facial nerve branches distal to the line drawn from the lateral corner of the eye to the angle of the mandible. Such injuries usually will be repaired by cross innervation; it can be repaired by primary or secondary microsurgery if indicated. The Bichat fat pad should be free and easily movable for repositioning as a pedicle flap, and insufficient dissection of the flap results in stretching of the pedicle of the flap, which can compromise blood supply and decrease the volume of the flap, in addition to dislodging the flap from the vascular pedicle. If this occurs, augmentation should be continued using avulsed fat pad material as a free fat graft, and the patient is followed. Revision surgery can be performed 3 to 6 months later using other procedures, such as filler injection or free fat grafting. Flap repositioning can be performed simply by using the hinge rotation of the flap around the zygomatic buttress (consisting of the body and buccal process of the BFP) at the center of rotation under the zygomatic arch and near the temporal and pterygopalatine processes of the fat pad.
FIGURE 5. Photographic views. A,B, Preoperative views. C,D, One-year postoperative views.

Previous studies have indicated that, regardless of gender, the average BFP volume is 9.5 mL. Therefore, the average volume of the body and buccal process (50 to 70%), which are measured during BFP lifting, is 5 mL. In contrast, in a recent study, the average amount of augmentation was 4.21 mL, and according to this study, the average amount of augmentation gained per milliliter is 0.84 mL.

If less augmentation is needed, partial extraction of the BFP can be performed. Other options, such as limited plication of extracted fat, also can be considered, although it is impossible to titrate the volume precisely.

**Flap Fixation and Incision Closure**

The repositioned pedicle flap is sutured to the surrounding preorbital subcutaneous tissues. Superficial preorbital dimpling may be observed. If this occurs, it can be resolved with local massage.

**Hollowing Effect**

BFP extraction has been an accepted method for many years to decrease buccal fullness, especially in obese patients. After extracting the fat pad, the malar bones can be projected more indirectly because of the hollowing effect at the lateral side of the oral commissures. The BFP can be used to augment the malar area using 2 mechanisms. In addition to the direct effect, it has an indirect effect, which was discussed earlier. This augmentation can be considered a useful effect, especially in obese and normal-weight patients, although it can result in undesirable consequences in thin patients who have a body mass index lower than the normal range. In the present series of patients, an undesirable hollowing effect was observed in only 1 patient who was thin, although the effect was mild and did not have any significant effect clinically or statistically.

Based on the present experience, the authors suggest that BFP lifting should not be performed in patients with a thin face, and it should be limited to patients with sufficient subcutaneous buccal and no presurgical hollowing (Fig 7C).

**Indications**

In the present series of patients, almost all BFP lifting procedures were performed in patients with esthetic

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**FIGURE 6.** A, Preoperative and B, postoperative views. A 29-year-old man underwent zigzag genioplasty, open rhinoplasty, malar and para-nasal prosthesis in combination with left buccal fat pad lifting (from Keyhan et al).
complaints owing to trauma, although a combination of rhinoplasty, zigzag genioplasty, bilateral malar and paranasal augmentation, and unilateral BFP lifting (left) after prosthetic augmentation in the left malar area with rigid implants to improve left malar projection in relation to opposite side was performed (Fig 6). Based on their experience, the authors recommend that BFP lifting should not be performed as an isolated procedure, but as an adjunct procedure in combination with orthognathic surgery, malar or paranasal alloplastic augmentation, panfacial fracture surgery, dimple creation surgery, or in combination with conventional or endoscopic midface lift procedures. In such cases, BFP extraction should be performed after finishing the other procedures, as was discussed earlier. After extraction of the flap, it can be fixed to the adjacent prosthesis or plated in subperiosteal fashion.

Use of the BFP lifting technique before facial lipo-structure should be considered an alternative technique to decrease the average amount of fat resorption (authors’ hypothesis).

**Time of Surgery**

The time of the surgery is not a challenging problem in patients undergoing surgery for old zygomatic fractures or esthetic reasons, but it should be considered an important step, especially in patients with recent fractures with severe hematoma or edema, which can result in a complex treatment plan. In such cases, BFP lifting can be performed after a 10-day grace period, and slight overcorrection (0.5 to 1 mL) can be considered in such cases.

**DATA COLLECTION**

The results of procedures such as fat grafting or repositioning surgery are difficult to evaluate completely and objectively. It is also difficult to evaluate the amount of fat augmentation and resorption without performing pre- and postoperative magnetic resonance imaging. Therefore, the authors decided to use a 2-dimensional facial analysis based on profile views, which was discussed in their previous article (Fig 2G). Evaluation can be performed using bird’s eye views or submental views.

Currently, a precise quantitative method does not exist when using these views. The present evaluation method is the only method that has been reported in published articles that allows a quantitative evaluation of such procedures. However, the
present method is 2-dimensional and thus has some limitations.

Use of the BFP for facial esthetic surgery was first described by Chung et al. However, the literature lacks data about the technique, indications, complications, and long-term results. The authors’ recent experience in this field has shown acceptable results. This method can be used as an alternative option for malar augmentation in patients undergoing surgery for esthetic reasons or after trauma, especially for severe comminuted zygomatic fractures, which may be impossible to reduce precisely.

Although free fat grafts also can be used in this clinical context, fat grafts have always represented a challenge in inducing the necessary neoangiogenesis, which results in significant resorption. As a result, the authors believe that this new open access technique should be considered an alternative method for the management of mild to moderate malar depression in patients undergoing surgery for esthetic reasons and after trauma.

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