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Malar and Submalar Augmentation

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Over the past four decades, revolutionary improvements in the design and manufacture of facial implants have broadened the application of midface augmentation. In the 1960s, Tessier [1] was among the first surgeons to use autogenous bone grafts to correct congenital and traumatic skeletal deformities. With the introduction of synthetic alloplastic implants in the latter half of the decade, midface implant augmentation expanded beyond its reconstructive purpose unencumbered by the inherent limitations of donor site morbidity, protracted operative times, and tissue resorption. In the early 1970s, Spadafora and Hinderer [2,3] independently described their early experiences in aesthetic facial enhancement using alloplastic biomaterial for bilateral malar augmentation. During this same period, Gonzalez-Ulloa [4] demonstrated that by altering the shape of cheek, midface augmentation as an adjunct to standard rhytidectomy improved the facial contour by producing fuller cheeks and a more youthful appearance. Although these preliminary efforts in profileplasty focused on enhancing bone structure and overall shape of the face, reversing the effects of aging on the midface was not considered foremost.

Later, as interest in facial aesthetics grew, and knowledge of the aging process matured, the use of alloplastic implants in facial rejuvenation surgery emerged as a natural corollary fueled by the contributions of several prominent surgeons [4–9]. After extensive modification of early implant prototypes, Binder's work in the 1980s launched midface augmentation as an independent, powerful method for midface rejuvenation [10]. Binder's increased emphasis of submalar soft tissue augmentation represented an important, innovative contribution. This technique, he demonstrated, could impact midface aesthetics significantly by restoring the volume lost because of soft tissue atrophy associated with aging. In the 1980s and 1990s, Terino [11] further advocated the use of alloplastic facial contouring as a method of enhancing the overall facial aesthetics.

Personal philosophy

The contemporary practice of facial rejuvenation reflects a 20-year culmination of rapid advances

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made in the understanding and treatment of midface aging [10,12–16]. During the natural aging process, the midface descends and the soft tissues atrophy in multiple facial planes. Acknowledging these pathophysiological processes, surgeons no longer characterize facial rejuvenation solely on the basis of the subcutaneous rhytidectomy procedure, but instead have extended its definition to embody deeper and more fundamental levels of dissection. By effectively elevating, supporting, and replacing lost midface volume, midface implant techniques attest to the fact that the face can be rejuvenated successfully not only through traditional suspension procedures, but also through augmentation of the soft tissue and skeletal foundation.

Midface augmentation using alloplastic implants confers many benefits. From a clinical perspective, the surgical procedure is straightforward and bears relatively few risks. Alloplastic midface implants are readily reversible and may be combined with standard rhytidectomy techniques. For the patient, aesthetic improvement is consistent, predictable, and enduring. Technically, midface implants can replenish deficient facial soft tissue volume and expand the anterolateral projection of the area, thereby reducing midface laxity and decreasing the depth of the nasolabial folds (Fig. 1). Submalar augmentation, performed alone, without concomitant rhytidectomy, can offer moderate midfacial rejuvenation to middle-aged patients (ages 35 to 45 years) who exhibit early signs of facial aging and atrophy, but lack the significant soft tissue laxity of jowls or deep neck rhytids (Fig. 2).

When combined with standard rhytidectomy procedures, midface implant augmentation ultimately softens the sharp angles and depressions of the aged face, leading to a natural unoperated look. Midface implants facilitate rhytidectomy by allowing the skin and soft tissue to be draped over a broader, more convex midface region after implant augmentation (Fig. 3). Additionally, if placed before rhytidectomy, midface implants reduce traction forces on the perioral tissues and lateral commissure, which assists in thwarting

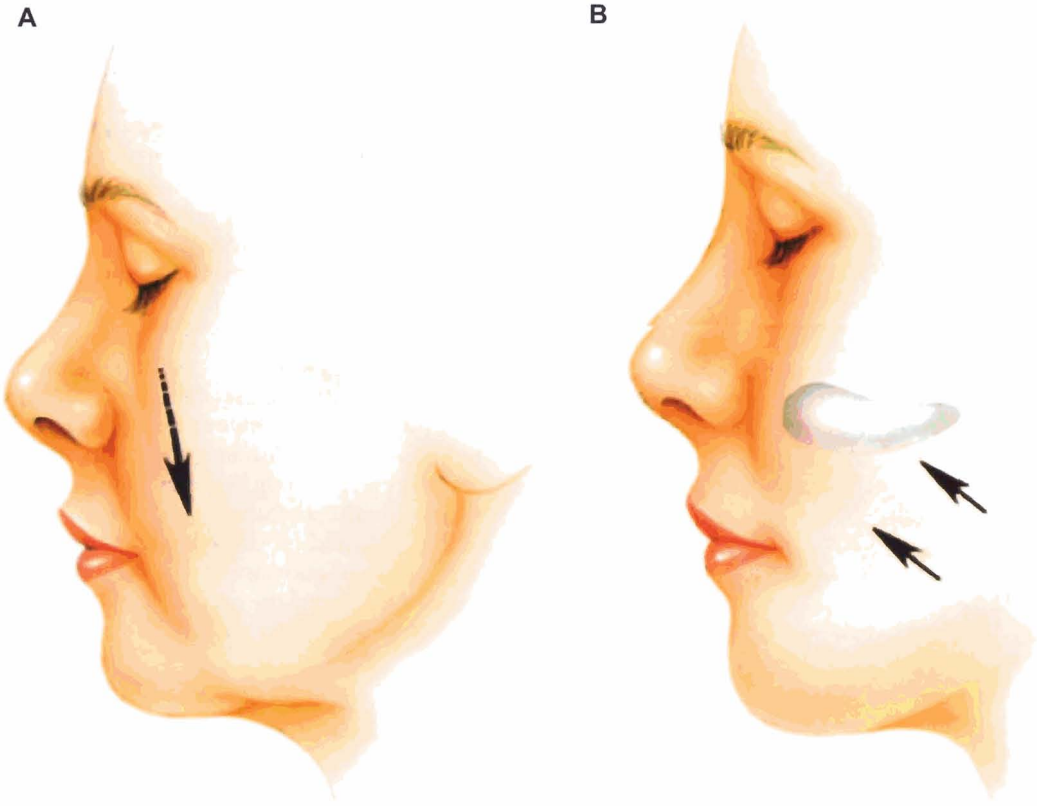


Fig. 1. (*A,B*) Suspension effect of midface implants. Midface implants augment the facial skeleton and restore soft tissue volume. The combined effect is to relocate the malar prominence to a more anterosuperior location and restore the hollow regions. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

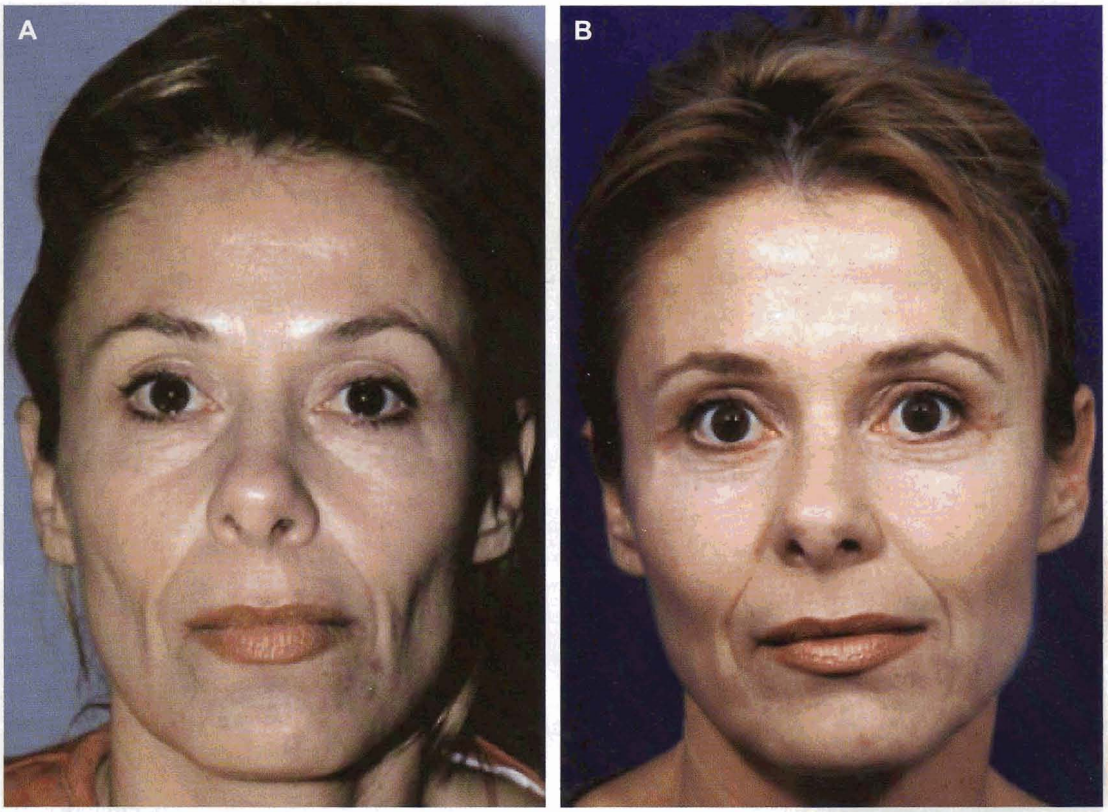


Fig. 2. Facial rejuvenation with submalar implant. (*A*) Preoperative view of 45-year-old female with submalar atrophy (type 2 midface deformity). (*B*) 3 year follow-up after submalar implant placement. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

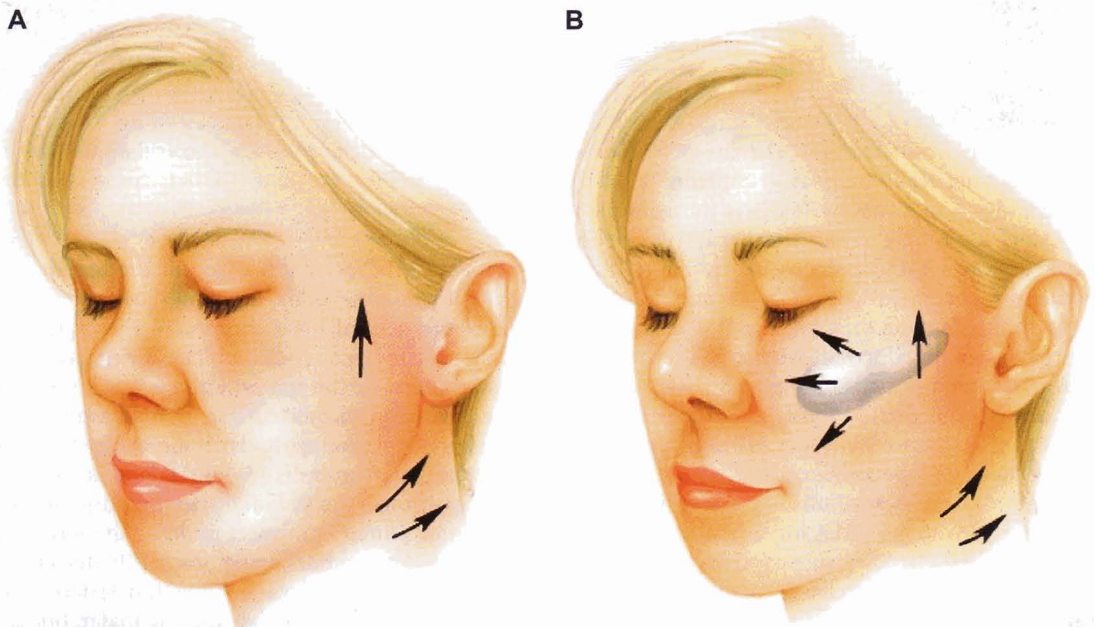


Fig. 3. Convexity effect of midface implants. (*A*) Facelifts generally stretch skin over a flat midface structure in a two-dimensional pattern. (*B*) Malar and submalar implants augment the bony and soft tissues of a more convex midface region that allows a more natural draping, resulting in a third dimension for facial rejuvenation. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

an overoperated appearance. Finally, dissection of the midface subperiosteum during implant placement releases the zygomaticocutaneous ligaments and deep attachments of the superficial musculoaponeurotic system (SMAS) to the facial skeleton, thereby permitting greater mobilization and suspension of ptotic soft tissues. The concept of placing an implant in this area as a spacer prevents rapid reattachment of the periosteum and keeps the midfacial soft tissues maintained in an elevated or suspended position. The authors have found this procedure to exponentially enhance and prolong the aesthetic outcomes of subperiosteal, sub-SMAS and deep plane rhytidectomy [13].

Hence, the synergistic aesthetic effect of midface implant augmentation and rhytidectomy lends wide application of these two techniques to various potential candidates. In patients with relatively poor bone structure who require rhytidectomy because of significant lower facial laxity, augmenting the bony scaffold of the malar region improves the fundamental base upon which facial tissues are suspended. Using this approach, recontouring the midface achieves dramatic satisfactory effects not otherwise attained through soft tissue techniques alone. Alternatively, those who have prominent malar skeletons but inadequate submalar soft tissue benefit from filling out of the midface inferior to the prominent zygomatic process. Further, patients requiring revision rhytidectomy with volume restoration also can be improved by expanding the midface region while simultaneously reducing the downward vertical traction forces on the lower eyelid.

For appropriate candidates, other popular aesthetic surgical approaches, such as the deep plane facelift, subperiosteal facelift, and fat grafting, offer viable alternatives to alloplastic implants [12–18]. If the underlying pathophysiology of the aging midface, such as volume loss or facial shape, is not addressed, however, these soft tissue procedures used alone may become disadvantageous and not infrequently problematic than beneficial. For example, despite improving the midface through suspension of the existing soft tissue, the subperiosteal midface lift, deep plane rhytidectomy, or extended SMAS procedures cannot replace the losses in deeper or superficial soft tissue associated with normal aging. The more radical methods produce significant edema, which may persist for several months. In the worst cases, facelift surgery may degrade the overall appearance by skeletonizing the facial structure, particularly in patients suffering from midfacial volume loss or those who have extremely prominent bone structure and thin skin.

Injectable soft tissue fillers, such as hyaluronic acids, calcium hydroxyapatite, and collagen, offer yet another option for improving midfacial aesthetics. These substances efface the nasolabial fold and may be especially useful in treating early-stage nasolabial lines and fold and mild facial atrophy in younger individuals. They lack the ability to significantly enhance midface volume, however, and their aesthetic effects are seldom permanent. Even injectable poly-L-lactic acid (Sculptra, Dermik Aesthetics, Bridgewater, New Jersey), which has demonstrated superior volume enhancement over other tissue fillers, generally requires annual maintenance. Similarly, inconsistencies in the long-term outcomes and durability of moderate-volume augmentation with free-fat transfer represent significant shortcomings of this technique. The most significant difference between soft tissue fillers and alloplastic implants is that the implant not only provides support and volume to the sagging soft tissue, but is able to also provide a dimensional quality to the face that is aesthetically desirable that just amorphously filling the face cannot accomplish.

Beyond their role in reversing the effects of aging, midface implants also have demonstrated utility in corrective, reconstructive, and therapeutic applications. Patients afflicted with facial atrophy consequential to conditions such as HIV lipodystrophy and anorexia can benefit aesthetically and functionally from midface implant augmentation (Fig. 4) [19]. Midface implants also can restore facial contour defects resulting from post-traumatic and congenital deformities while sparing the patient from the risks and morbidity associated with lengthy reconstructive surgeries and the use of donor grafts [20]. The authors also successfully have placed facial implants in patients who had significant unilateral facial and muscle atrophy caused by longstanding facial paralysis and Bell's palsy.

Anatomy

Abundance of facial soft tissue in the absence of sharp irregularities or indentations most typically alludes to a youthful, healthy appearance with aesthetically-pleasing facial contours [21]. The effects of the aging process on the anatomical constituents of the face have been chronicled and detailed extensively. The aging process typically commences between the third and fourth decades of life and accelerates rapidly through the fifth and sixth decades. In general, three primary processes underlie the observed changes in the midface aging process: 1) descent of soft tissue, 2) loss of tissue volume, and 3) decreased skin elasticity. As the fat pads in the malar, buccal, temporal, and infraorbital regions atrophy and lose their facial support, these areas become progressively ptotic because of gravitational effects. Inferior decent of the malar fat pad, suborbicularis oculi fat

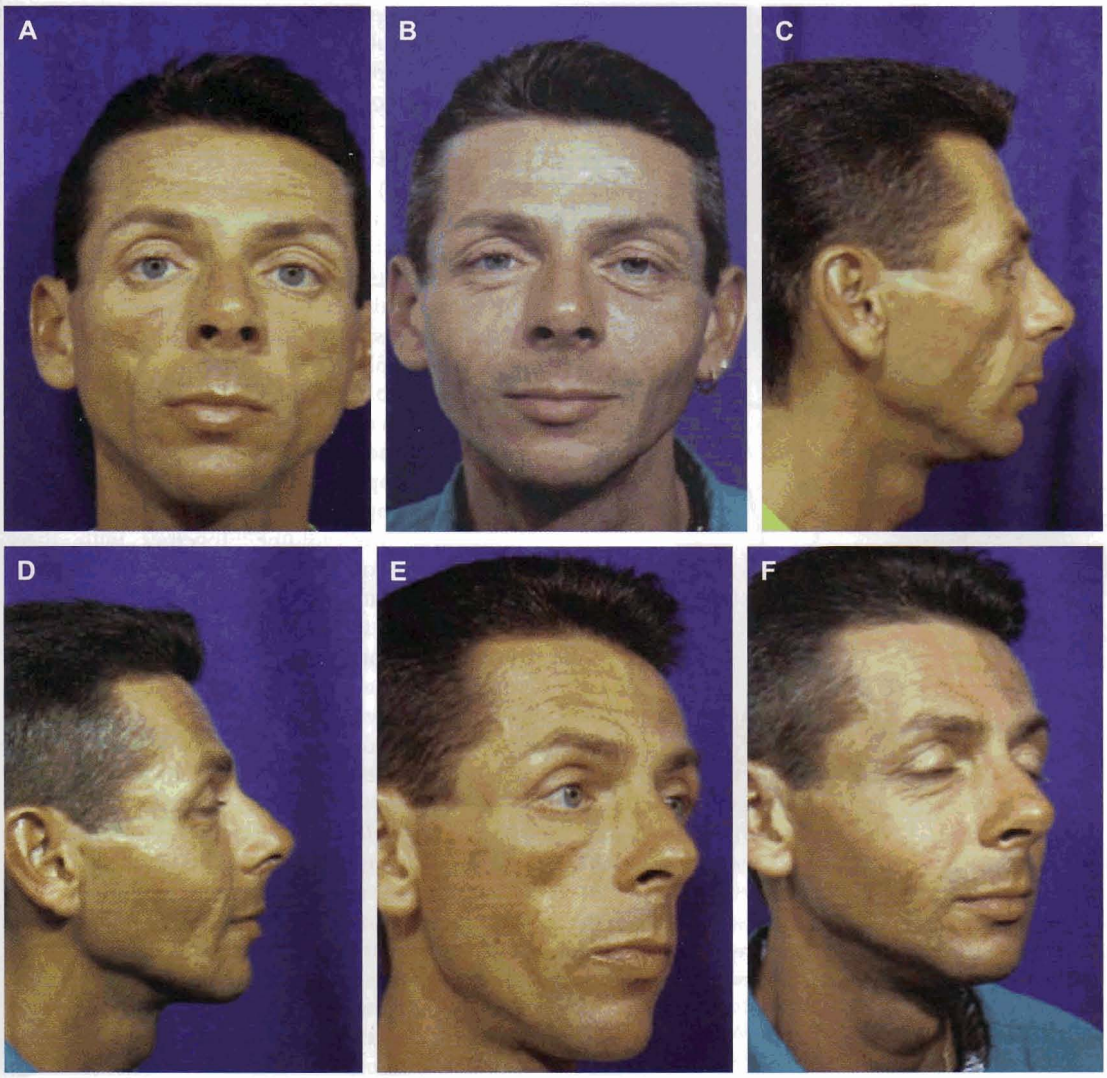


Fig. 4. Submalar midface implants for treatment of HIV lipodystrophy. (*A*, *C*, and *E*) Preoperative views of 34-year-old male. (*B*, *D*, and *E*) 1-year follow-up after customized submalar implant placement. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

(SOOF), and the orbicularis oculi muscle ensues, exaggerating the nasolabial folds and exposing the infraorbital rim. In conjunction with deepening of the nasolabial and nasojugal folds, cavitary depressions and submalar hollowness develop. These changes initially flatten the midface, thereby unmasking the underlying bony anatomy and leading to an aged, fatigued appearance.

Understanding the soft tissue and bony landmarks of the midface is critical for effective surgical treatment of the aging face. The malar eminence, a vital and common focus of implant augmentation, resides in the anterior one third of the zygomatic arch. Placement of the traditional malar implants in this area will lateralize the apex of the cheek and create a higher and more angular malar eminence. Another key region of the midface is the submalar triangle, which is confined superiorly by the zygomatic prominence, medially by the nasolabial fold, and laterally by the masseter muscle. This anatomical area represents the most common site of volume loss in the aging midface, but can be contoured and rejuvenated easily with alloplastic implants (Fig. 5).

Preoperative analysis

Preparation for facial rejuvenation surgery includes a complete history and physical examination followed by photographs and optional digital

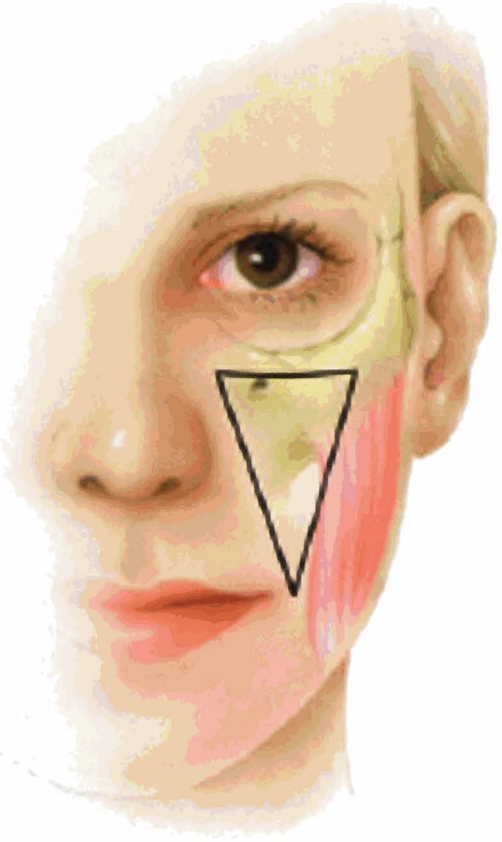


Fig. 5. Submalar triangle. The submalar triangle is bordered superiorly by the zygomatic prominence, laterally by the masseter muscle, and medially by the nasolabial fold. It is the most common area of deficiency with aging. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

imaging. The latter procedures can help the patient identify the exact nature of his or her concerns. Because many midface augmentation candidates require other surgical procedures to improve the overall facial aesthetics, it is also essential to examine and analyze the upper and lower face. Photographs taken from the basal and apical bird's eye view can aid in quantifying the degree of midface pathology and assist in selecting the appropriate implants. Preoperative analysis of skeletal and soft tissue asymmetries can prevent exaggeration of these effects postoperatively.

Selecting the appropriate facial implant involves the ability to recognize the characteristic patterns of midface deformity (Table 1) [22,23]. Optimal evaluation entails separate analyses of the bony malar region and the soft-tissue component comprising the submalar region. Patients exhibiting type 1 deformity with primary hypoplasia and ample midface soft tissue are suited best for malar shell implants that cover the bony midface. These implants yield an arched and laterally projected cheek (Fig. 6). When compared with traditional malar button implants, the newer shell implants offer improved stability and are less prone to migration and its larger surface area. Additionally, fine edges gradually blend into the adjacent areas to avoid undesirable abrupt or sudden changes in facial topography.

Patients who have type 2 submalar deficiency, the most common deformity of the aging face, are characterized by normal malar skeletal structure and soft tissue atrophy of the midface. With aging, the soft-tissue components of the midface begin to atrophy and lose volume. Together with these changes, inferior descent of the midface inflicts a hollowed-out appearance and leaves a flat, dull-appearing facade. Submalar implants are the implants of choice for patients who have type 2 deficiency. These implants fill in the midface depressions and provide greater anterior projection to the flattened face (see Fig. 2; Figs. 7 and 8).

Type 3 deficiency is marked by a combination of bony malar hypoplasia and soft-tissue volume loss. The effects of aging are exaggerated in these patients, because bony support is negligible and facilitates the ptotic soft tissues to readily descend inferomedially toward the nasolabial folds and oral commissure. Malar–submalar implants are particularly beneficial for patients who have type 3 deformity (Fig. 9). Most of these patients do not qualify for rhytidectomy alone, because they lack sufficient skeletal support to maintain resuspension of the skin and soft tissue. Thus, the results of this procedure without concomitant augmentation procedures are often suboptimal and the effects short-lived.

Surgical technique

General guidelines

Available biomaterials for midface augmentation include silicone, polytetrafluoroethylene (Medpor, Porex Surgical Products, Newnan, Georgia), and expanded polytetrafluoroethylene. The authors favor silicone implants because of their flexibility, low associated infection rates, and their ease of insertion and removal [6–11]. Although the subciliary and lateral facelift approaches occasionally are used for implant insertion, transoral placement of the implant in the subperiosteal pocket offers the most advantages. First, this approach facilitates easy insertion and direct visualization of all midface

Table 1: **Patterns of midface deformity**

Type	Description of deformity	Augmentation required	Implant type to use
Type 1	Primary malar hypoplasia: malar bony deficiency with adequate soft tissue. Face lacks desirable features of angular, well-defined cheeks.	Requires primarily lateral projection of the malar eminence; results in a high-arched, laterally projected cheeks	Malar implant: shell-type extends into the submalar space for more natural result
Type 2	Submalar deficiency; soft tissue deficiency with adequate malar bone. Face appears dull and flat; most common deficiency of the aging face.	Requires anterior projection of the midface and submalar hollow; restores lost midface volume characteristic of a more youthful face	Submalar implant: placed over the anterior maxilla and the masseter tendon, extending into the submalar space
Type 3	Combined malar and submalar deficiency: volume-deficient face with inadequate bony and soft tissues. Marked by premature signs of aging.	Requires both anterior and lateral projection of the entire midface and submalar regions	Combined malar–submalar implant: lateral (malar) and anterior (submalar) projection to fill a large midfacial void

Adapted from Binder WJ. A comprehensive approach to aesthetic contouring of the midface in rhytidectomy. Facial Plast Surg Clin North Am 1993;1(2):235; with permission.

anatomic structures, particularly, the infraorbital nerve. Additionally, there is the obvious advantage of avoiding external skin scars and inferior dissection aids in preventing traction on the lower lid postoperatively. The process of capsular fibrosis facilitates tight adherence of the silicone implants to the facial skeletal in the subperiosteal plane, which protects against implant migration during the postoperative period [23]. Because the implant is exposed to oral microbes, however, a theoretical disadvantage of the transoral approach is the potential risk of contamination of the surgical site and wound infection. Thus, mitigating this risk requires meticulous surgical technique.

The type of facial deficiency may determine the sequence of procedures when performing implant augmentation and rhytidectomy concomitantly. Type 1 and 3 patients who require a major malar component to the midface augmentation procedure or have significant facial asymmetry should have their implants inserted before rhytidectomy. This allows the surgeon to compensate for structural changes that may not be evident after swelling occurs. In this instance, the wound is either left open until the end of the rhytidectomy procedure, or a Penrose drain is placed into the oral incisions to prevent the formation of seromas and hematomas. For most patients who require only submalar soft tissue augmentation, such as those with type 2 deformity, the surgeon can perform the rhytidectomy procedure before placement of the alloplastic implant. Here, the advantages include the ability to maintain a dry implant pocket, reduction of subperiosteal bleeding, and the capability of closing the intraoral wound immediately following augmentation to reduce the risk of infection. In both cases, local anesthetic is injected and the area infiltrated in similar manner as if it were a primary implant procedure.

Preparation for surgery

Prophylaxis with a broad-spectrum oral antibiotic is started 1 day before the procedure. In the preoperative holding area, the patient sits upright, and crucial areas of the midface are marked (Fig. 10). These demarcated areas should feature the midface volume deficit, areas of depression, infraorbital nerve axis, and the malar eminence. The medialmost border of the typical midface implant may be situated readily by locating the infraorbital nerve, which lies along the midpupillary line when the patient is staring straight ahead. Having the patient smile broadly assists in determining the most inferomedial position of the implants and ensures that there is no interference with the facial mimetic function. The markings should resemble a reverse topographical map outlining the areas of maximal depression and requiring maximal augmentation. After the skin is marked, the patient can view his or her face in a mirror and decide if the proposed changes are satisfactory.

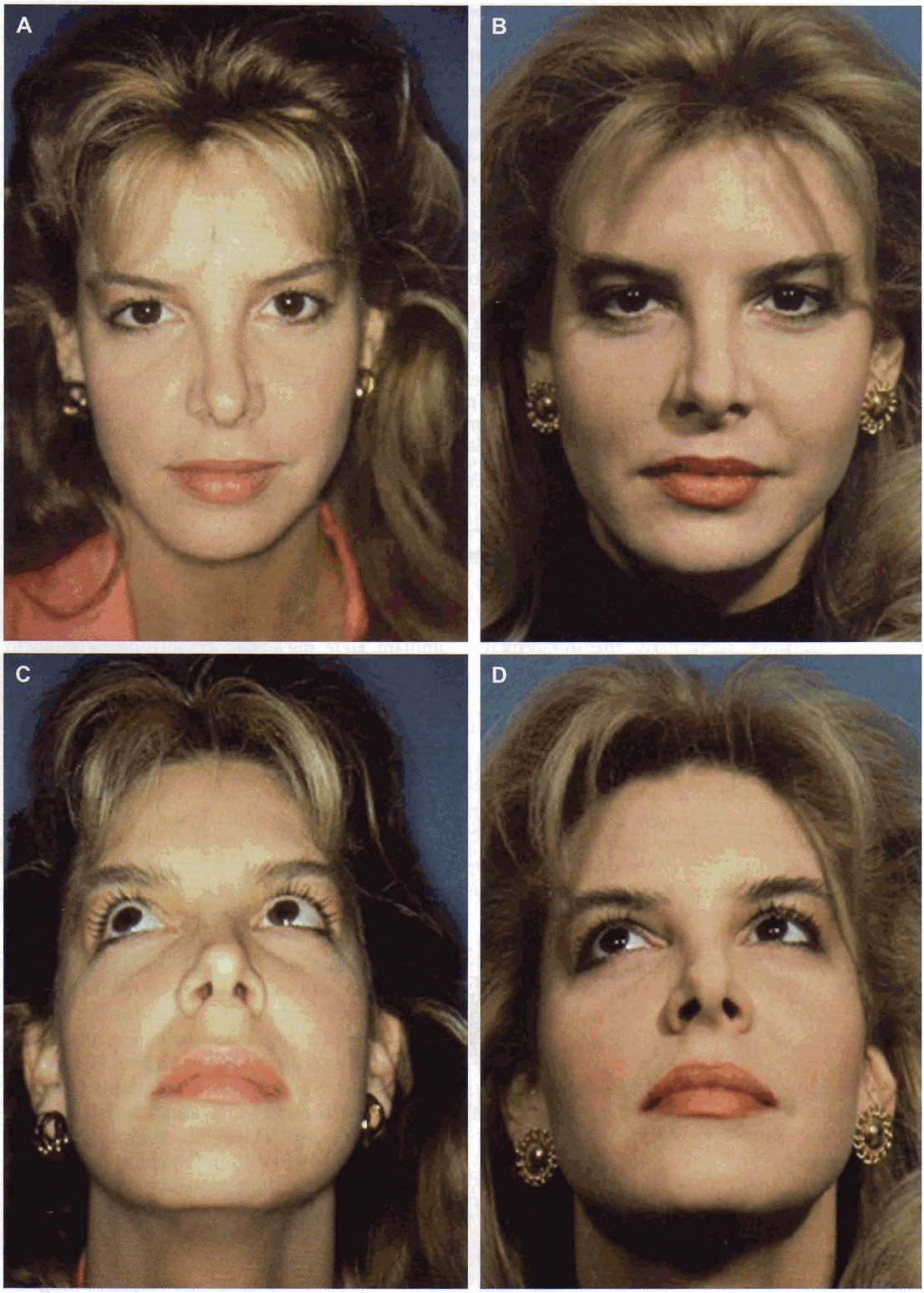


Fig. 6. Type 1 midface deformity. Preoperative photograph (*A* and *C*) of patient with type 1 malar hypoplasia, with relative deficiency of the midface skeleton. Postoperative photograph (*B* and *D*) after placement of malar shell implants. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

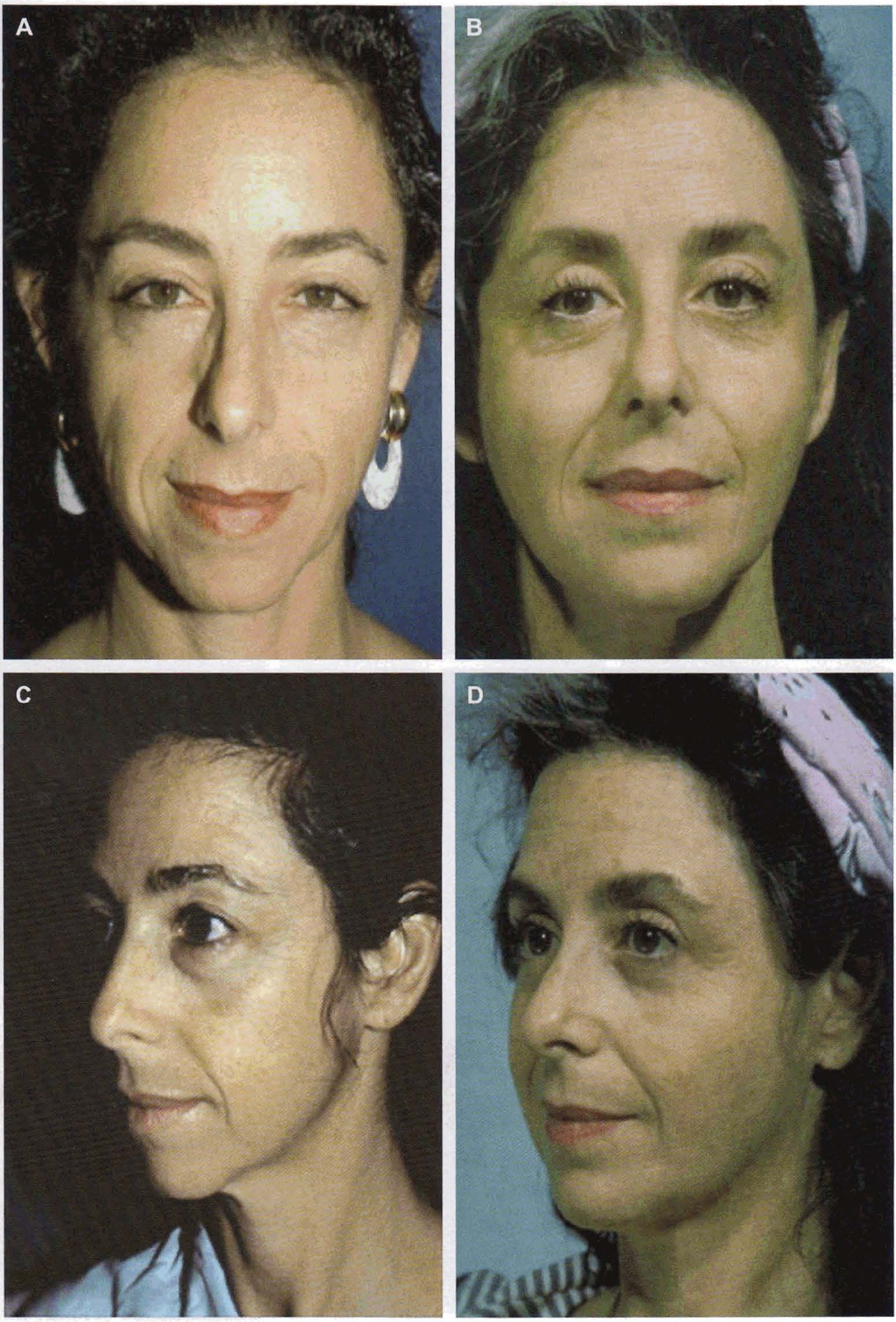


Fig. 7. Type 2 midface deformity. Preoperative photograph (*A* and *C*) of patient with type II submalar deficiency; she has adequate facial skeleton but deficiency of the submalar soft tissues. Seven-year postoperative photograph (*B* and *D*) after placement of submalar and chin implants demonstrating the long-term enhancement of facial rejuvenation. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

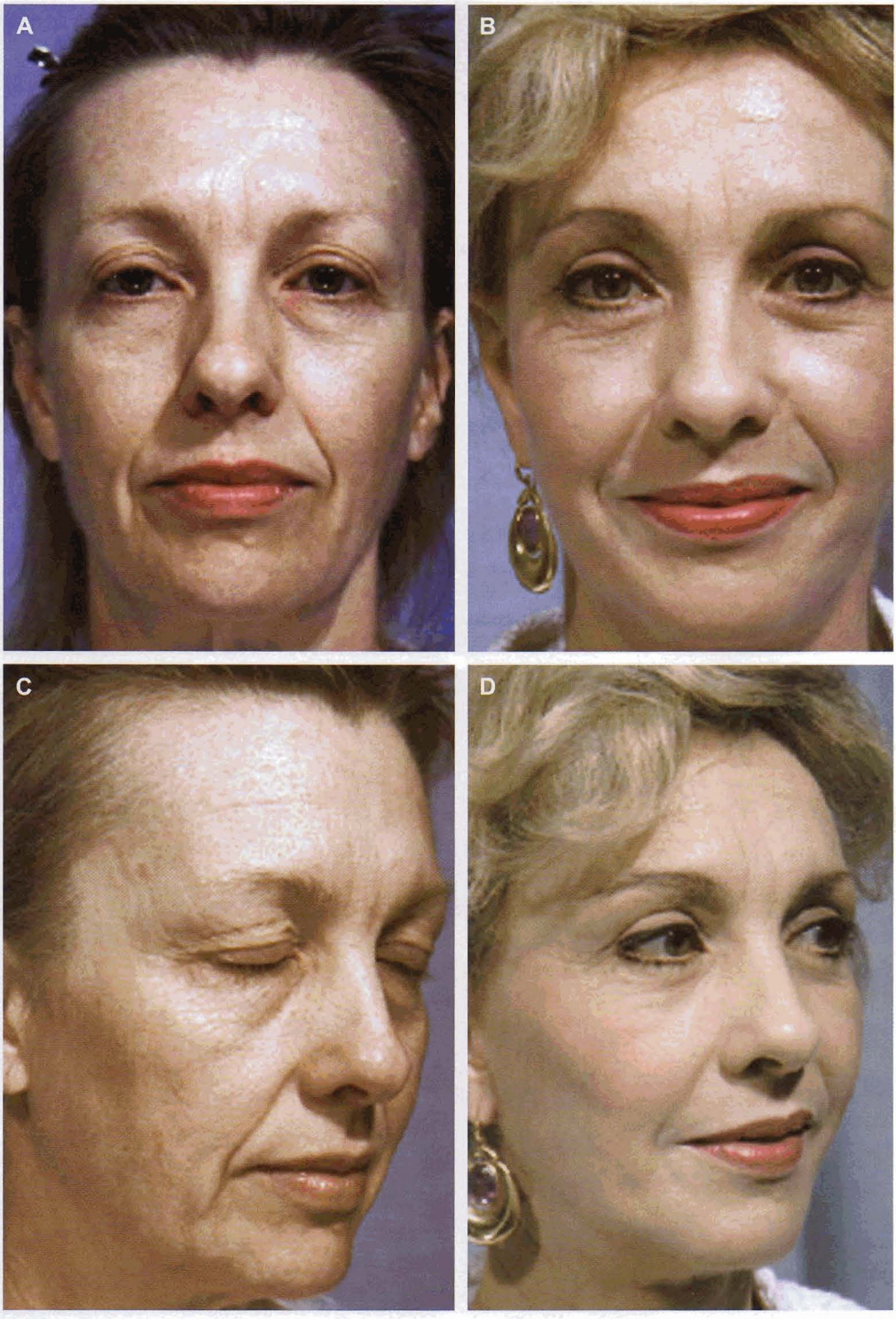


Fig. 8. Type 2 midface deformity with dermatochalasia and lower facial laxity. Preoperative photograph (*A* and *C*) of patient with type 2 submalar deficiency, aging eyes, and lower facial laxity. Postoperative photograph (*B* and *D*) after placement of submalar implants, facelift, and upper and lower blepharoplasty. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

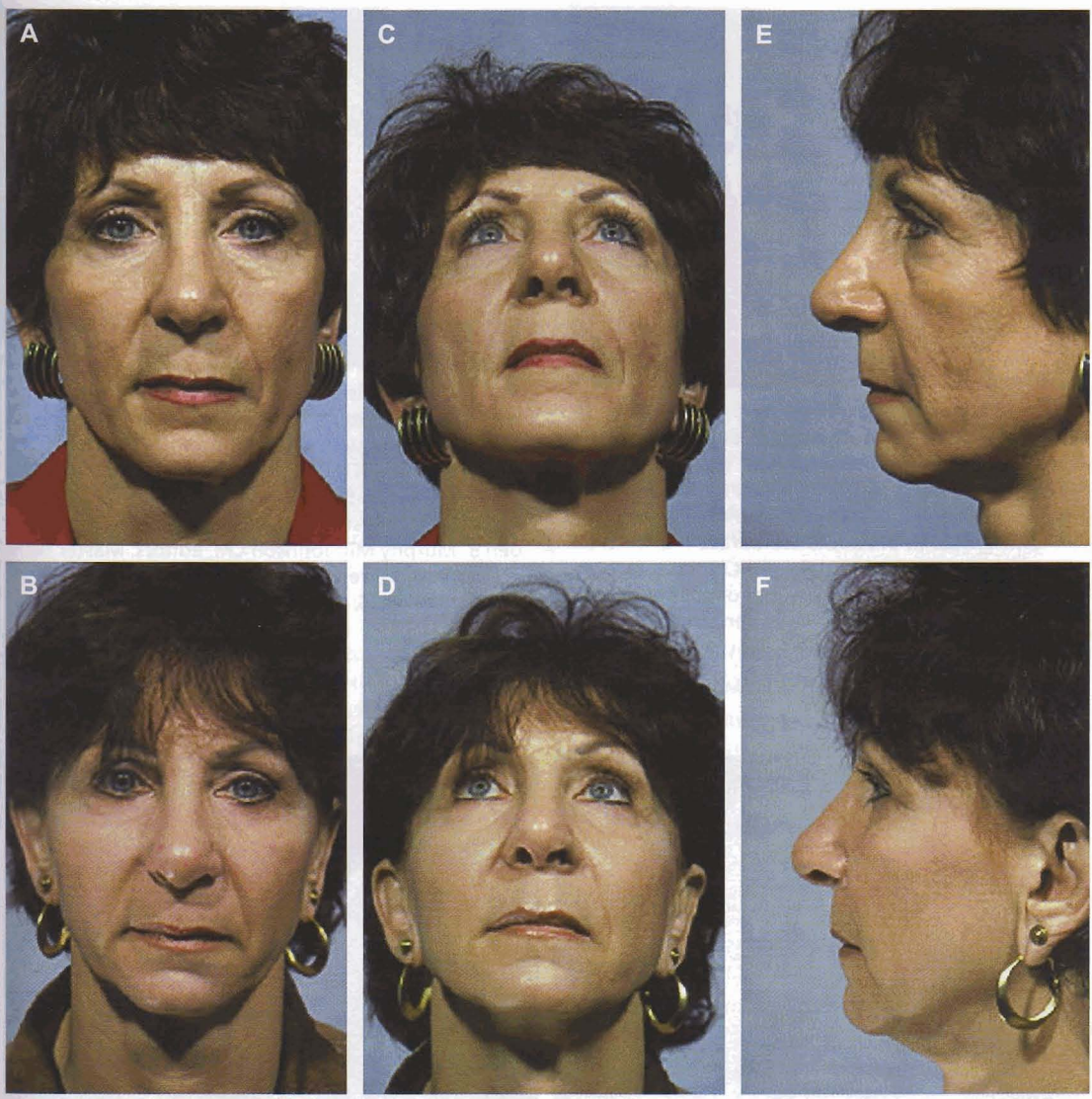


Fig. 9. Type 3 midface deformity. Preoperative photograph (*A, C* and *E*) of patient with type 3 volume-deficient face who lacks adequate facial skeletal structure and soft tissue bulk. Postoperative photographs (*B, D* and *F*) after placement of combined malar–submalar implants with enhanced midface volume and overall improvement of facial aesthetics. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

Intravenous antibiotic and steroids are used routinely intraoperatively. After the patient has achieved adequate anesthesia by means of intravenous sedation or general anesthesia, the surgeon injects 1% or ½ % lidocaine with epinephrine into the gingival–buccal sulcus and the midface in the subperiosteal plane. In order to aid even dispersion of the local anesthesia and minimize contour irregularities due to accumulated fluid, hyaluronidase (Wydase, Wyeth-Ayerst, Philadelphia, Pennsylvania) is added to the anesthetic solution and the face is then massaged. The operative site is prepared with povidone–iodine (Betadine, Purdue Frederick, Norwalk, Connecticut) from soaked gauzed sponges inserted into the gingival–buccal sulcus at the level of the canine fossa for 10 minutes.

Incision and dissection of the malar eminence

Because the mucosa can stretch to accommodate larger implants, insertion of the implant requires only a 5 mm stab incision in the gingival–buccal sulcus over the lateral canine fossa and maxillary buttress (Fig. 11). The incision is rendered in an upward oblique direction and is carried immediately

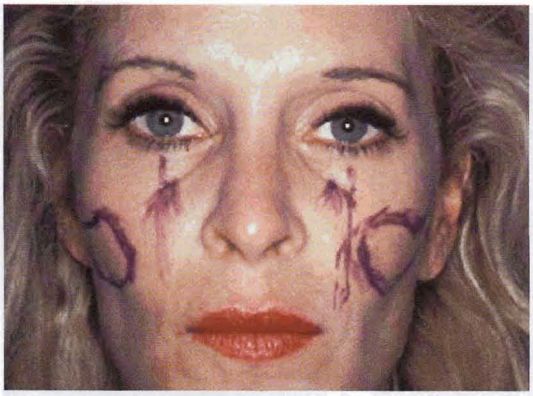


Fig. 10. Preoperative markings. With the patient sitting upright, the areas of midface deficiency requiring augmentation are marked. The infraorbital nerve axis along the midpupillary line designates the medial border of dissection. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

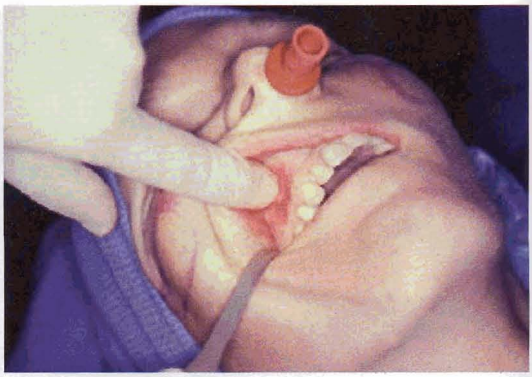
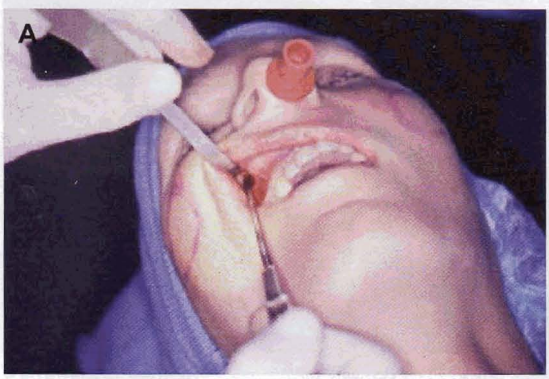
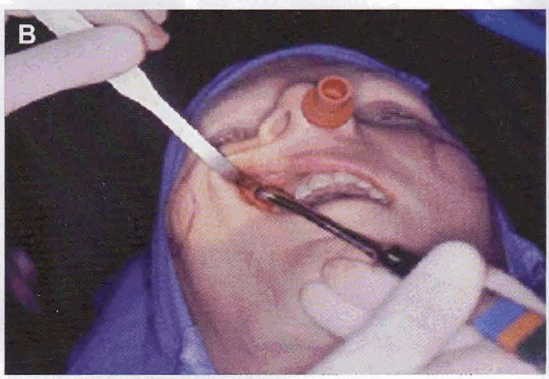


Fig. 11. Oral incision. The gingival–buccal incision is made over the lateral canine fossa. Only 5 mm are required for adequate dissection and exposure of the midface skeleton. A 1 cm to 1.5 cm cuff of gingival is maintained inferiorly. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)





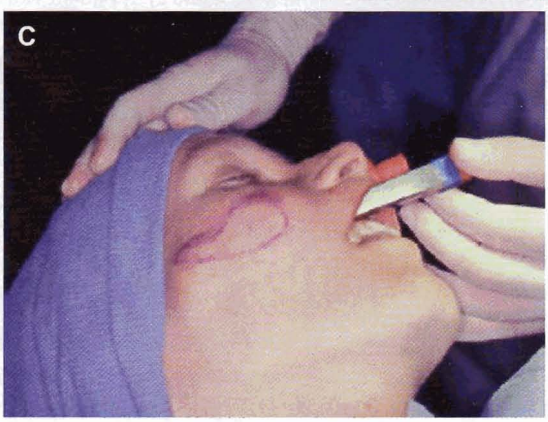


Fig. 12. Periosteal elevation. The periosteum is elevated over the maxilla superiorly and laterally. The borders of dissection are the masseteric tendon and infraorbital rim. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

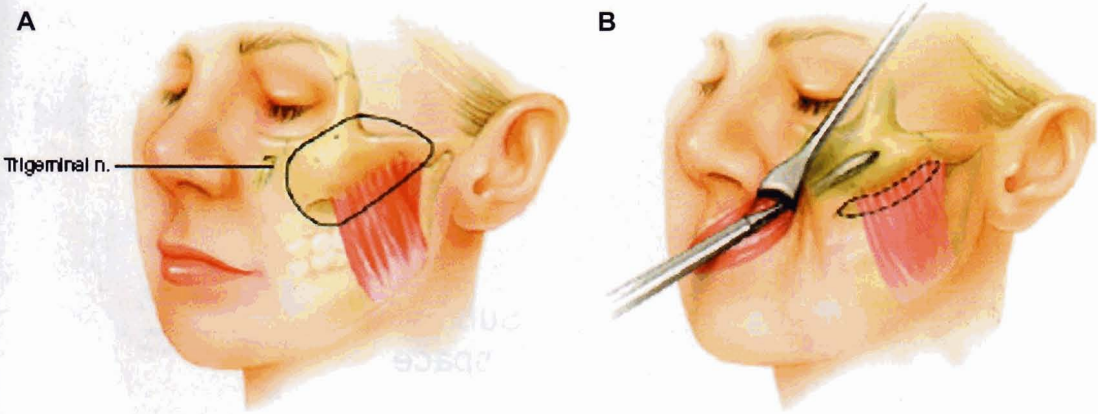


Fig. 13. Periosteal elevation. (*A*) Initial dissection over the anterior maxillary wall. (*B*) The stippled area represents the submalar dissection over the masseteric tendon. The dashed line represents the area that generally is elevated. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

and directly to the maxillary bone. Bleeding can be minimized by compressing the mucosa against the bone. A minimum cuff of 1 cm facilitates closure at the end of the procedure. Removing dentures during the operation is unnecessary, because they do not interfere with insertion of the implant, and actually direct placement of the incision above the denture to the correct location.

After the initial incision, the periosteum of the anterior maxilla is elevated superiorly and laterally (Figs. 12 and 13). Following the preoperative markings, the surgeon uses his or her external free hand to provide crucial guidance to the direction and extent of dissection. The subperiosteal elevation is initiated with the Joseph elevator, which is changed quickly to a broader 10 mm Tessier elevator (Fig. 14) to avoid excessive dissection, stretching, and traction around the infraorbital foramen. The infraorbital nerve should be identified carefully if the proposed implant is large or bears a significant medial component. This prevents placing the implant over the foramen.

Dissection then is extended laterally to the malar–zygomatic junction and zygomatic arch. The subperiosteal plane is used for dissection, particularly over the lateral zygomatic, where branches of the facial nerve traverse just superficial to this plane (Fig. 15). Injuring the temporal branch of the facial nerve can be avoided by using gentle blunt dissection over the midzygomatic arch, ensuring the dissection is on bone and within the subperiosteal plane. Here, a broad elevator is far safer than a delicate thin instrument, which can more readily puncture the periosteum laterally because of limited visibility during the procedure.

Exposure of the submalar triangle and creation of an implant pocket

Patients who have type 2 and 3 midface deficiencies require exposure of the submalar space. This anatomic hollow extends about 3 cm below the zygoma. In order to expose this region, the subperiosteal dissection is continued inferiorly below the zygoma and over the superior tendinous insertion of the masseter muscle. Gentle elevation of the overlying soft tissue from the deeper plane of the tendon facilitates visualization of the glistening white tendinous attachment of the masseter (Fig. 16). The muscle attachments are not divided, because they serve as a critical platform for the inferior portion of the submalar implant. The submalar space narrows significantly posteriorly and is not

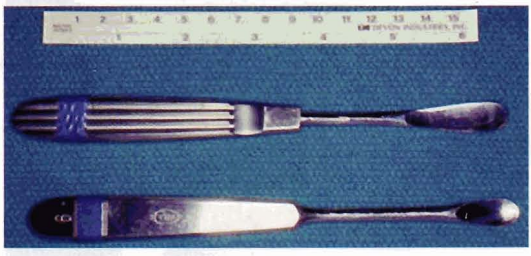


Fig. 14. Instruments—periosteal elevators. Periosteal elevation begins with the Joseph elevator to gain initial access, but most of the dissection should be performed with the 10 mm Tessier elevator. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

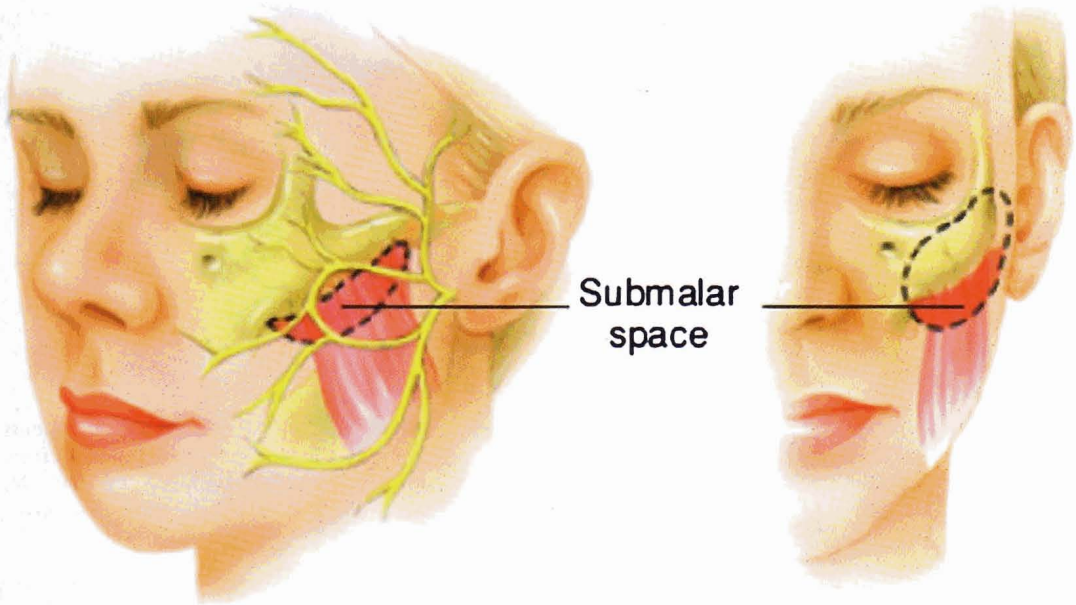
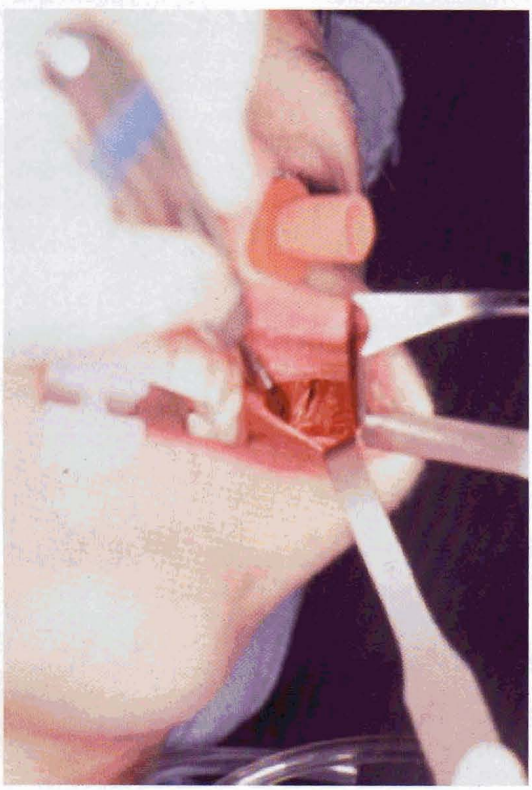


Fig. 15. Facial nerve branches in the region of dissection. It is crucial to dissect in the subperiosteal plane over the zygomatic arch, to avoid injury to the temporal branch of the facial nerve. The use of a broad elevator will help prevent perforation of the periosteum in this region. The buccal branches are also at risk if the region over the masseter is dissected aggressively. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)



accessed easily. Careful dissection of the posterior limit can be accomplished by advancing a blunt elevator along the interior border of the zygomatic arch. Masseter muscle contraction at its superior border tends to be limited, thereby preventing postoperative implant displacement.

A pocket large enough to accommodate the appropriate implant is created over the malar–zygomatic complex and submalar triangle. The dissected space always should be sufficiently larger than the implant so that the implant can easily fit into it without being compressed by the surrounding tissues, particularly in the posterior region. Displacement of the implant can occur if an implant is forced into an inadequately sized pocket, or if the

Fig. 16. Submalar triangle and masseteric tendon. The lateral aspect of the dissection will be over the masseteric tendon, inferior to the lateral zygomatic arch. In this region, the soft tissues are elevated gently over the glistening white fibers of the tendon, allowing placement of the tail of the submalar implant. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

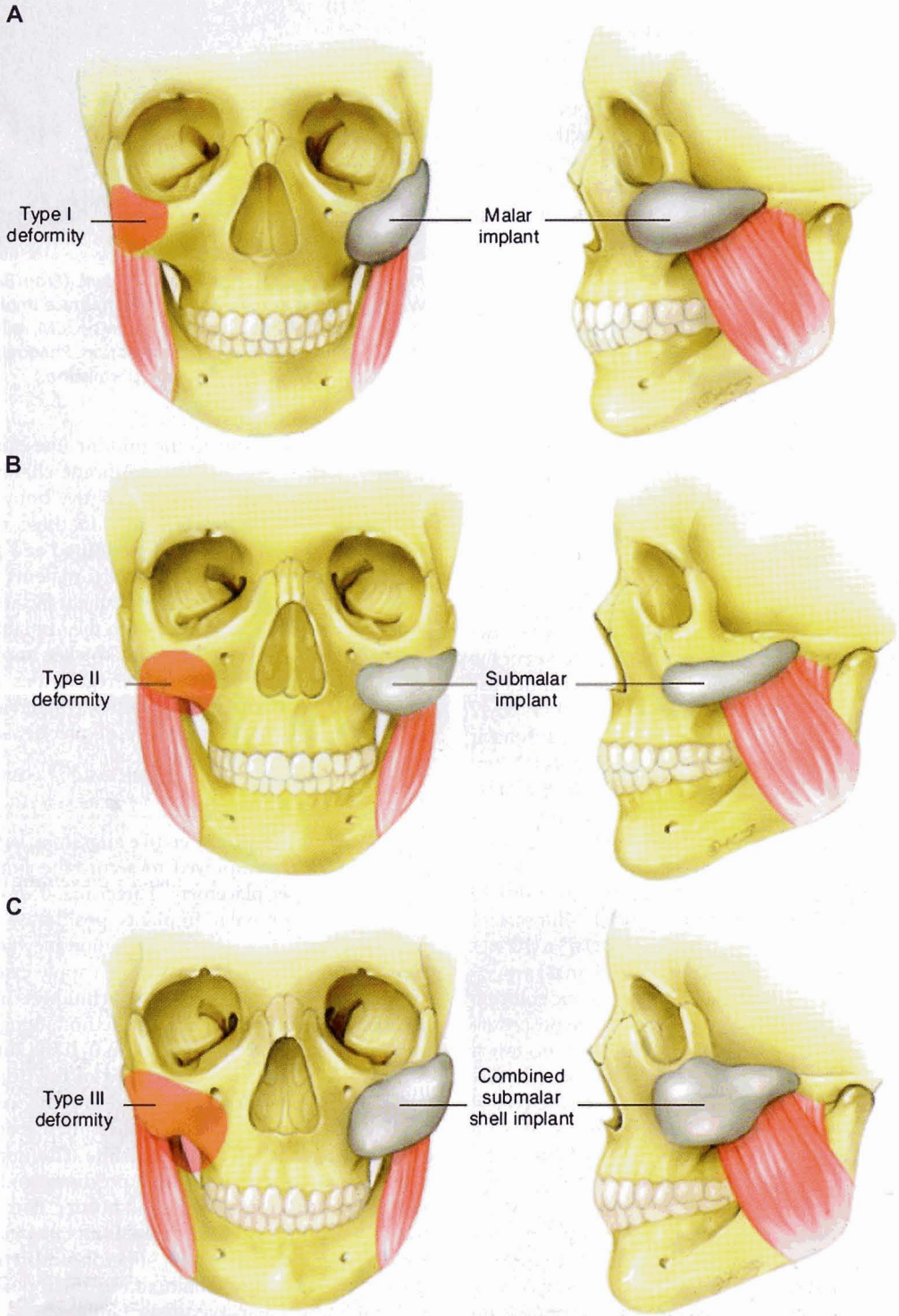


Fig. 17. Implant placement. Malar shell implants for type 1 deformity rest on top of the malar and zygomatic bone in a more superior and lateral position. Submalar implants for type 2 deformity generally lie over the anterior face of the maxilla. Combined malar–submalar implants for type 3 deformity will cover both the malar bony eminence and the submalar triangle. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

posterolateral portion of the pocket is poorly exposed. In the latter case, constriction of the area will push the implant anteriorly, causing it to migrate or extrude. When the implant is situated in the dissected space, one generally should be able to move it at least 3 to 5 mm in all directions. After closure of the wound, even after a large pocket is made, the periosteum and soft tissues contract; the pocket immediately closes down around the implant, and the dead space usually is obliterated within 24 to 48 hours [22].

Insertion of the implant

Preoperative facial analysis in conjunction with the type of deformity and the patient's desires typically determines the location and size of the implant. Selecting the appropriate midface implant should take into account the bulk of the overlying tissue and formation of the fibrous capsule. Therefore, it is best to choose an implant that is marginally smaller than the desired volume changes. In type 1 deformities, malar shell implants lie on top of the malar and zygomatic bone in a more superior and lateral position (Fig. 17), whereas in type 2 deficiencies, submalar implants generally rest over the anterior face of the maxilla. Type 3 deformities use combined malar–submalar implants that cover both the malar bony eminence and the submalar triangle. In order to achieve the desired facial contour changes, positioning an implant in the submalar triangle typically requires greater experience and judgment than necessary for implants placed over the malar eminence. Regardless of the type of augmentation, however, the end aesthetic result should achieve the desired changes in facial contour and correspond to the preoperative facial markings rather than to the underlying skeletal anatomy.

Implants should be bathed in antibiotic solution (Bacitracin 50,000 U/L) at the start of the procedure and allowed to soak into insertion. A no-touch technique should be practiced, if possible, to ensure minimal implant handling and reduce the risk of contamination. An assortment of different implant sizes and shapes should be readily available in the operating room, and the surgeon must be capable of customizing these implants (Fig. 18). Sizers should be used to determine and confirm the appropriate implant size and shape. Modifications to the implant shape then can compensate for overall size, shape, and facial asymmetry. Shaving an implant as little as 1 mm can impact the final aesthetic result significantly, especially in patients who have thin facial skin.

Assessing for facial symmetry is critical following insertion of the implants. The surgeon can use a ruler to measure the distances from the medial

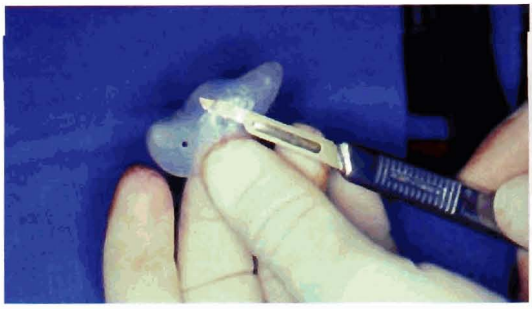


Fig. 18. Intraoperative carving of implant. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

border of the implants to the midline. Pre-existing facial asymmetry can pose significant challenges and require exquisite attention to the bony and soft tissue topography (Fig. 19). In these cases, each implant may need to be contoured and positioned asymmetrically. Additionally, patients who have particularly thin skin or prominent facial skeletons may require modifications in the implants, as the edges and contours of larger, thicker implants tend to be palpable with visible irregularities. After placing both implants, the surgeon may stand at the head of the table to acquire a more precise assessment of contour symmetry.

Securing the implant

In order to prevent postoperative migration, various methods can be employed to secure the implant following proper placement. Larger malar or combined malar–submalar implants positioned over the zygoma and not prone to migration may not require fixation. The authors prefer to apply external suture fixation using one of two techniques. In the indirect lateral suture fixation method, long (10 in) double-armed Keith needles on 0–0 silk sutures are passed through the lateral end of the implant (Fig. 20). The needles are inserted into the wound and directed posterolaterally; they then exit the temporal region behind the hairline. The implant then is placed into the final position, and the sutures are tied over a cotton roll bolster. This technique works best with malar shell implants in type 1 deformities by applying a superolateral tension on the implants and maintaining their position over the bony malar–zygomatic eminence.

The second suture method, the direct external fixation (Fig. 21), is better suited for submalar and combined malar–submalar facial implants in type 2 and 3 deformities. It is also the preferred technique when the implants are excessively mobile within the wound pocket or when asymmetrical

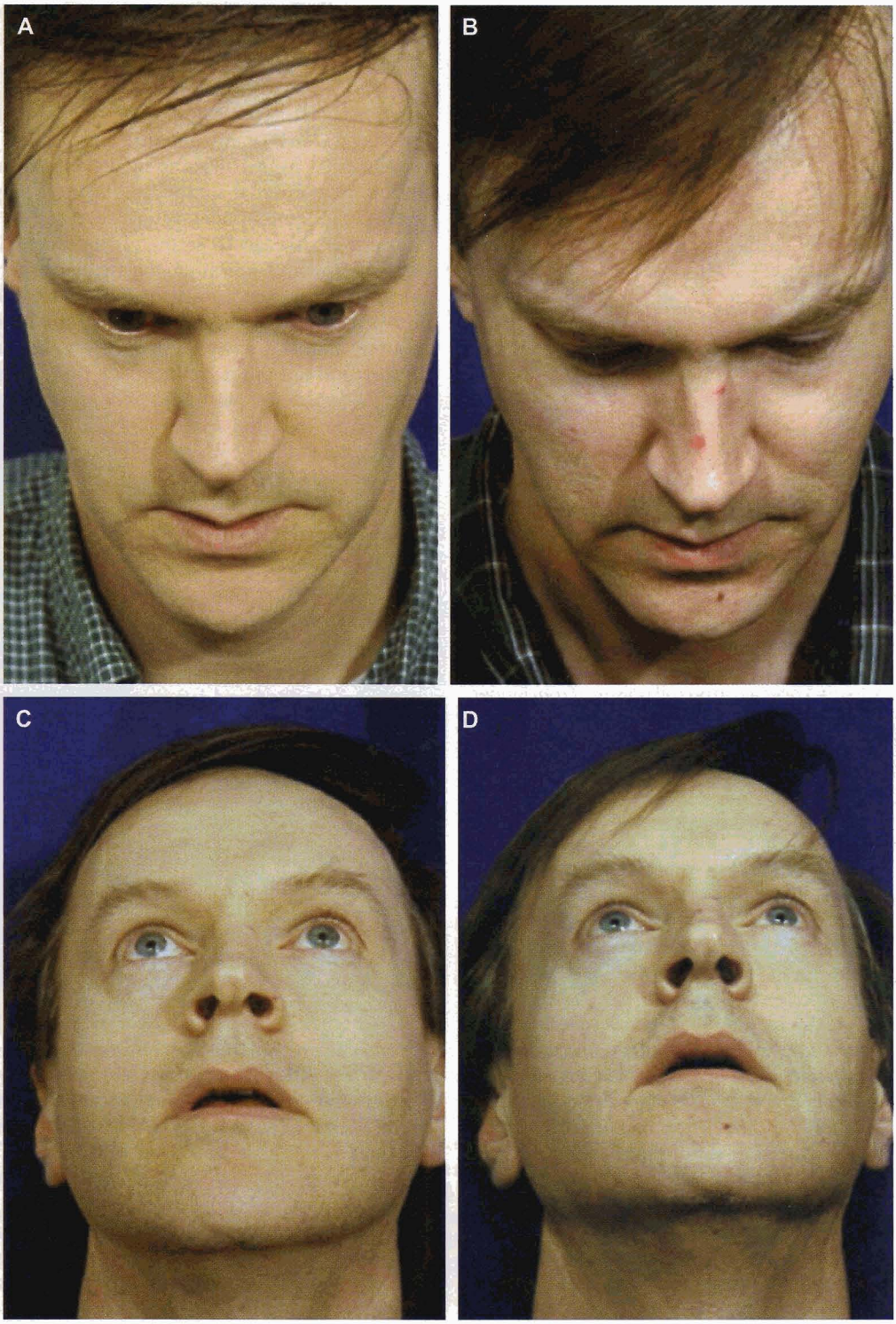


Fig. 19. Facial asymmetry. (*A, B,* and *D*) This is a common pattern seen with patients who have facial asymmetry. The patient's right side is narrower with malar eminence in a higher position and more projected. The left side is wider and more posteriorly displaced. (*C* and *E*) Postoperative photograph after placement of asymmetric midface implant placement. A medium malar shell implant was placed in the right side, whereas a large combined malar–submalar implant was placed in the left side of the face. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

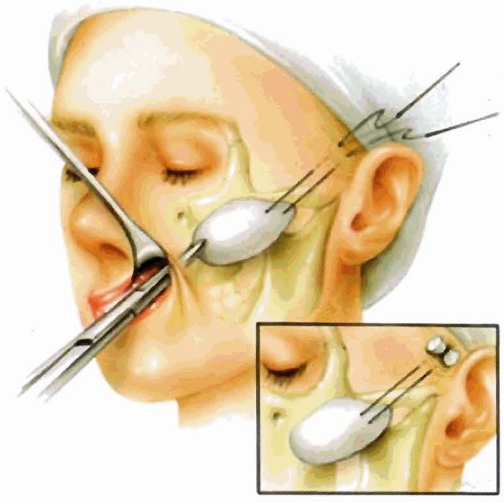


Fig. 20. Indirect lateral suture fixation. This method is best for malar shell implants (type 1 deformity) by applying a superolateral tension on the implants and maintaining their position over the bony malar–zygomatic eminence. Long (10 in) double-armed Keith needles on 0–0 silk suture are passed through the lateral end of the implant directed posterolaterally, exiting the temporal region behind the hairline. The implant then is placed into the final position, and the sutures are tied over a cotton roll bolster. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

placement of implants becomes necessary. Midface implants usually have two preformed fenestrations, of which, the position of the medial fenestration should be marked on the external skin while the implant resides in the subperiosteal pocket. Using a right-angle clamp to push the implant upward, underneath the fenestration, the holes can be located, and the resulting external protuberance can be marked on the skin. Symmetry can be confirmed by measuring and comparing the distance of each marking to the midline. After marking the medial fenestrations, the skin should be marked to coincide with the location of the lateral fenestration of the implant. This is done by first removing the implants and placing them on top of the midface. The implants then are positioned to coincide with the desired contour and preoperative markings. The second skin mark is applied to match the location of the lateral fenestration of the implant. After passing double-armed 3–0 silk sutures through the medial and lateral fenestrations with the loop around the deep surface of the implant, the needles are placed into the wound pocket and passed perpendicularly through the skin markings corresponding to each fenestration. The implant then is delivered into the pocket, ensuring proper position and symmetry. Finally, the sutures are tied gently over cotton roll bolsters overlying the anterior cheek. These bolsters aid in compressing the midface, reduce any potential dead space, and prevent fluid from collecting in the subperiosteal pockets. The external sutures and bolsters may be removed 24 to 48 hours postoperatively.

Implants also can be secured using internal suture fixation and attaching the medial aspect of the implant to the periosteum and soft tissues. Screws additionally can be used to fix the implant ensuring that the screw is placed over the lateral buttress and not in the canine fossa. If the implant is placed before rhytidectomy, it is left in place with the oral incision temporarily or loosely closed. After completion of the rhytidectomy, the oral incision is reopened to fix the implant with external sutures. Intraoral Penrose drains may be placed if necessary.

Wound closure and dressing

Intraoral incisions are irrigated copiously with antibiotic solution before closing them in one layer using chromic sutures. The external suture bolsters are covered with bandages, and an elastic facial dressing is applied and left in place for 24 hours. The authors' preference is a full elastic garment dressing that allows even compression of the midface (Fig. 22). As the elastic dressing applies adequate pressure to obliterate the pocket posterior to the implant, the suture bolster closes the midface pocket anterior to the implant. Patients are encouraged to use this elastic dressing after the bolsters are removed for an additional 24 to 48 hours. If midface augmentation is performed with rhytidectomy, and bolsters are in place, a lighter neck and facial dressing composed of cotton and cling is used instead of the compression garment.

Postoperative care

Patients may convalesce postoperatively at home or in an aftercare facility. They are advised to use ice packs for 3 to 4 days and sleep with the head elevated. Antibiotics, analgesics, and antinausea medication are prescribed to all patients. The first follow-up visit occurs on the first postoperative day, at which time the facial dressings and bolsters and any intraoral drains are removed. The mask then may be reapplied and worn for another 24 to 48 hours. This considerably reduces the postoperative swelling and reduces the overall postoperative recovery time. Although patients are followed regularly until resolution of facial edema, they are typically able to resume nonexertional routine activity 3 to 5 days postoperatively. In general, approximately

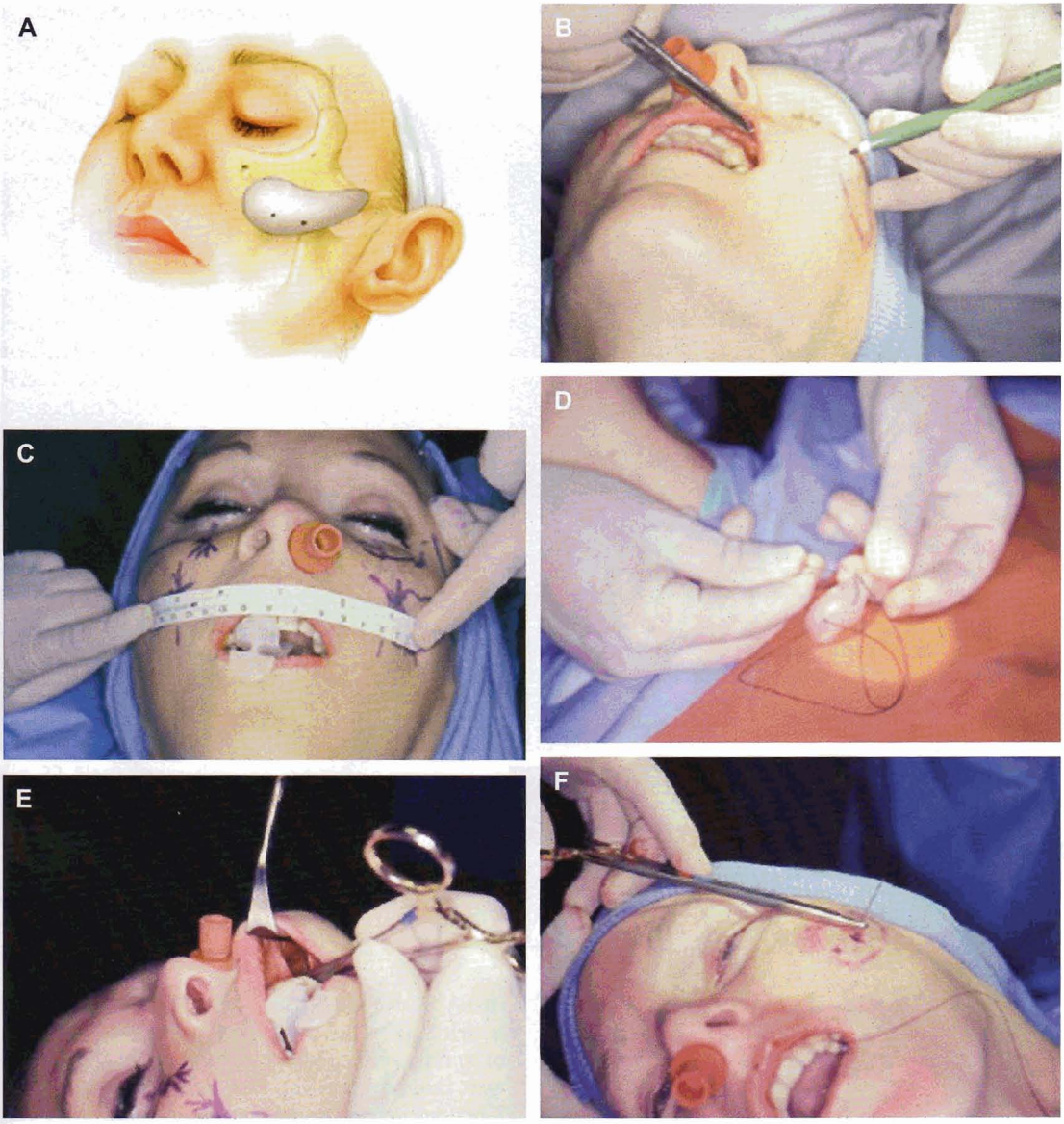
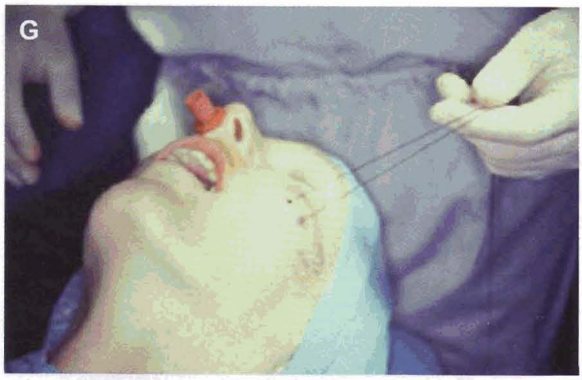
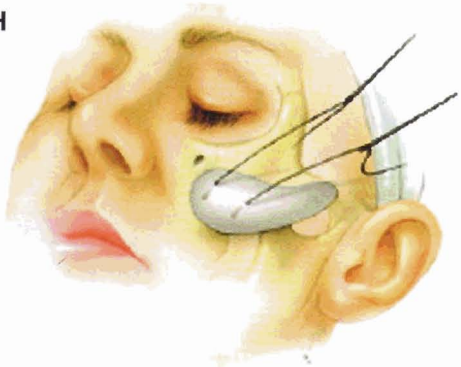
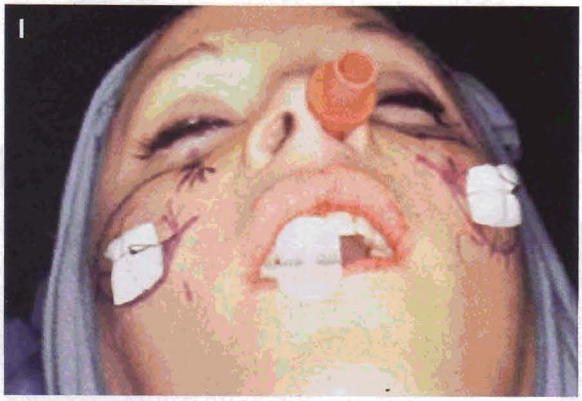
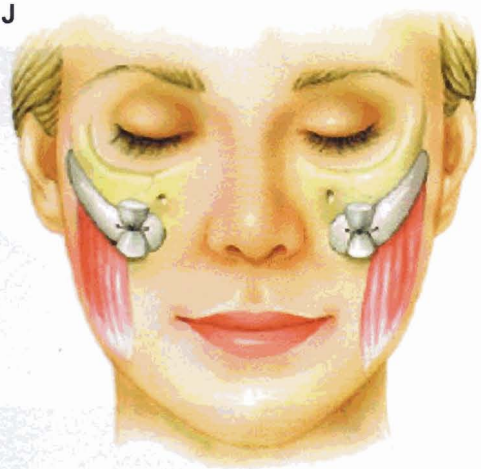


Fig. 21. Direct external fixation. Direct external fixation allows precise fixation and is suited best for submalar and combined implants in type 2 and type 3 patients. (*A*) The implant is adjusted in the pocket to obtain the exact desired location. (*B*) A right angle clamp is used to mark the location of the implant fenestrations by pressing behind the fenestration outward through the facial skin and marking the area of protuberance. A second fenestration mark is placed to ensure adequate orientation. (*C*) Symmetrical placement of marking is checked. (*D–H*) The suture needles are passed through the fenestrations points and passed perpendicular through the skin markings corresponding to each fenestration. (*I, J*) After ensuring precise location and adequate fixation of the midface implants, the sutures are tied over a cotton roll bolster. (*K*) Benzoin and a flexible band aid then can be placed over the bolster. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)









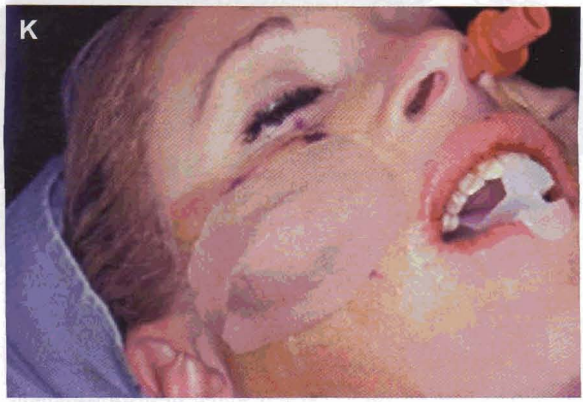


Fig. 21 (*continued*)

80% to 85% of the facial edema resolves within 3 to 4 weeks, and the remaining 15% to 20% gradually will subside over the subsequent 6 months.

Complications

Malposition and errors in implant selection represent the most frequent complications of facial implant augmentation [6,24]. Incorrect positioning, insufficient pocket size, or inadequate fixation of the implant can lead to postoperative displacement. During the immediate postoperative period, patients should be assessed within 48 to 72 hours after surgery to ensure against significant facial asymmetry. Implant extrusion, however, is extremely rare and usually occurs through the intraoral incision because of an inadequate dissection of the posterolateral pocket.

Augmentation using alloplastic silicone implants has an estimated infection rate of approximately 1% [24]. Measures to minimize the risk of infection include soaking the implant in antibiotic solution, irrigating the wound pocket, and avoiding the accumulation of fluid and blood in the surgical pocket. Other complications may include bleeding, hematoma, and seroma. Placement of drains can aid in

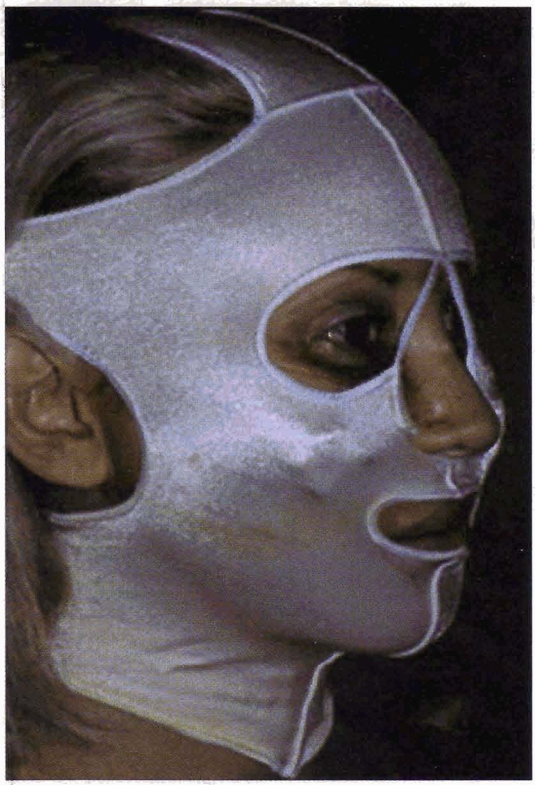


Fig. 22. Elastic facial dressing. A full-face compression garment can help reduce postoperative edema and fluid collection. (*From* Binder WJ, Kim BP, Azizzadeh B. Aesthetic midface implants. In: Azizzadeh B, Murphy MR, Johnson CM, editors. Master techniques in facial rejuvenation. Philadelphia: Saunders; 2007. p. 197–215; with permission.)

preventing fluid collection, especially when concurrent rhytidectomy is performed or when there is excessive bleeding during the procedure. Injury to the infraorbital nerve also has occurred and may result in infraorbital numbness persisting from days to weeks postoperatively. This effect, however, is seldom permanent. Other potential risks include damage to the frontal branch of the facial nerve during dissection of the zygomatic arch and injury to buccal branch with aggressive masseter dissection.

Summary

Understanding the principal of external facial form and careful attention to basic techniques and principles of surgery result in greater predictability in facial contouring. Critical analysis of the patient's face and precise communication between patient and surgeon lead to optimal patient satisfaction. Overall, facial implant procedures provide the patient with a powerful surgical modality to significantly change his or her facial appearance. Although challenging, midfacial augmentation procedures provide major rewards that few aesthetic procedures can offer.

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