

Clinics Review Articles

**FACIAL PLASTIC SURGERY CLINICS
OF NORTH AMERICA**

Minimally Invasive Procedures in Facial Plastic Surgery

EDITOR

Theda C. Kontis

CONSULTING EDITOR

J. Regan Thomas

MAY 2013

The Role of Fillers in Facial Implant Surgery

William J. Binder, MD^{a,*}, Karan Dhir, MD^b,
John Joseph, MD^{a,c}

KEYWORDS

- Facial implant surgery • Cheek augmentation • Malar augmentation • Facial alloplastic implants
- Chin implant • Chin augmentation • Facial fillers • Facial rejuvenation • Facial augmentation

KEY POINTS

- Achieving optimal, long-lasting results in facial rejuvenation requires knowledge of how the aging process affects all levels of the face including the skin, soft tissue, and underlying bone structure.
- Facial fillers and alloplastic implants are 2 methods commonly used to achieve the goal of volume enhancement for rejuvenation of the face. It is important to understand the appropriate use of each technique either as a sole modality or in conjunction with each other to attain optimal aesthetic results.
- Although minimally invasive soft-tissue augmentation procedures such as fillers have effectively improved the midface treatment paradigm, chin augmentation with alloplastic implantation remains the mainstay of treatment of microgenia.



Dr Joseph demonstrates midface facial filling with Sculptra and discusses his preparation of the materials for tear trough and midface injection in a video that accompanies this article.

TREATMENT GOALS USING FILLERS AND IMPLANTS

Augmentation of the midface and chin with alloplastic implants has been performed with increasing frequency during the past 4 decades and offers a long-term solution for augmenting skeletal deficiencies, restoring facial contour irregularities, and rejuvenating the face.^{1,2} Specifically, chin augmentation with alloplastic implantation is the fastest growing plastic surgery trend among all major demographics. The media have also well publicized the advantages of this technique, which has been characterized as “chinplasty” in mainstream magazines, further heightening the awareness of both the aesthetic and psychological benefits of treating microgenia.³

In contrast, rates of midface alloplastic implant procedures have increased at a measured pace during the past 2 decades because of the introduction of “less-invasive” techniques such as injectable facial fillers and fat transfer.^{4,5} Alloplastic implantation of the chin remains the optimal choice for projecting and repositioning the soft tissue envelope, whereas facial fillers have gained popularity in rejuvenating the aging midface.⁵ This more recent reliance on less-invasive surgical and nonsurgical rejuvenation procedures has minimized the key role of the skeletal structure component of the aging midface. However, rather than replacing surgical augmentation techniques, fillers can enhance the ability to use midface implants more effectively to achieve long-term rejuvenation.

No financial disclosures.

^a Department of Head and Neck Surgery, University of California, Los Angeles, 120 South Spalding Drive, Suite 340, Beverly Hills, CA 90212, USA; ^b Department of Head and Neck Surgery, Harbor-University of California, Los Angeles, 120 South Spalding Drive, Suite 340, Beverly Hills, CA 90212, USA; ^c Department of Head and Neck Surgery, University of California-Harbor, Los Angeles, 9400 Brighton Way, Suite 203, Beverly Hills, CA 90210, USA

* Corresponding author.

E-mail address: info@doctorbinder.com

Facial Plast Surg Clin N Am 21 (2013) 201–211

<http://dx.doi.org/10.1016/j.fsc.2013.02.001>

1064-7406/13/\$ – see front matter © 2013 Published by Elsevier Inc.

The Process and Effects of Aging in the Face

Successful rejuvenation of the aging face entails a multidimensional approach to correct the volumetric changes involving the skin, deep soft tissue, and bony skeleton.⁶⁻⁸

- Integumentary changes such as epidermal thinning, decrease in collagen, loss of skin elasticity, and deep tissue volume loss represent the hallmarks of soft-tissue changes in the aging face.⁶
- With advancing age, fat in the malar, buccal, temporal, and infraorbital regions atrophies and produces volumetric changes.
- Fat atrophy extends beyond the subcutaneous level and affects the deeper soft tissues along with the fat pad of Bichat. With continued wasting of the fat pads and loss of fascial support, these areas become progressively ptotic due to gravitational effects.
- The malar fat pad, suborbicularis oculi fat, and orbicularis oculi muscle descend inferiorly, exposing the infraorbital rim, and produce an elevation or "mound" lateral to the nasolabial fold and exaggerate its depth.
- The nasolabial and nasojugal folds deepen, leading to cavitory depressions and hollowness in the submalar regions.
- These changes may also flatten the midface and eventually unmask the underlying bony anatomy.

Over time, the progressive cumulative effects of aging transform the once full, angular, youthful face into a predictably rectangular (or pear-shaped) face, which appears longer in configuration, aged, and fatigued.⁸

Most soft-tissue deficiencies in the aging midface are localized within the recess referred to as the "submalar triangle," an inverted triangular area of midfacial depression bordered superiorly by the prominence of the zygoma, medially by the nasolabial fold, and laterally by the body of the masseter muscle. The aging midface exhibits a "double convexity" curvature caused by weakening of the lower eyelid orbital septum and consequent pseudoherniation of the lower orbital fat pads.^{2,8,9}

Age-related morphologic skeletal changes, well described by Shaw, must also be considered during the preoperative consultation. Overall, the aging face is characterized by the resorption of bone along the orbit, midface, and mandible, which leads to a reduction in the skeletal framework and laxity of the overlying skin. The net result of these topographic changes can make an otherwise healthy person appear gaunt.^{6,7} These changes are further compounded if the patient

exhibits deficiencies in skeletal structure such as a negative vector of the infraorbital rim.

Midface Rejuvenation

The specific goals for midface rejuvenation are to^{8,9}

1. Add contour to the upper midface or malar area
2. Restore cheekbone fullness and reduce submalar hollows
3. Soften the nasolabial and marionette folds
4. Reduce the vertical descent of the jowl
5. Smooth out facial lines and wrinkles

Initially, facial rejuvenation techniques were tailored to improve skin laxity alone. In the 1980s, Binder first introduced midface alloplastic augmentation as an independent method for volumetric enhancement of the aging face.² Augmentation not only enhances the facial skeleton but also achieves a suspensory effect that redistributes the soft tissue in a more favorable position. By restoring lost facial soft tissue volume and increasing the anterior projection of the area, midface augmentation reduces midface laxity, restores facial contour, and decreases the depth of the nasolabial fold. This result can be accomplished with implantation alone and in combination with a rhytidectomy procedure, whereby augmentation can soften the sharp angles and depressions of the aged face, rendering a more natural postoperative result.^{8,9} For these patients, augmenting the bony scaffold of the malar or maxillary regions improve the fundamental base for suspending the facial tissues. This emphasis on volume restoration continues to represent a key contribution to facial rejuvenation.

Later, less-invasive soft-tissue volume restoration techniques such as fat transfer and injectable facial fillers were developed to restore soft-tissue volume loss in the midface.¹⁰⁻¹² Facial fillers are safe and effective; require a short learning curve; and over the more immediate term, are cost-effective for treating mild to moderate soft-tissue volume loss. Numerous specialties have adopted their use in the office setting, and often commercially produced fillers do not require a physician for their administration. Fueled by increased public knowledge resulting from direct consumer marketing and advertising, facial fillers have proliferated in both numbers and types during the past few decades. Originally, soft-tissue fillers such as collagen were used to smooth out superficial changes such as epidermal and dermal rhytids. Over the years, diverse types of fillers offering longer duration times and improved standards of safety and immunogenicity have been introduced to restore volume and

contour to the aging face. Fillers are now used to treat nasolabial folds, lips, atrophic scars, the glabella, forehead, and Marionette lines. Thicker versions of hyaluronic acid-based fillers, calcium hydroxyapatite (Radiesse), and biostimulating fillers such as poly-L-lactic acid (Sculptra) and polymethylmethacrylate (Artefill) have also been used for enhancing the volume of the midface, mental, and mandibular regions.^{12,13} Relying on minimally invasive techniques as a sole procedure, however, may harbor inherent limitations that frequently result in suboptimal short-lived aesthetic effects. Similarly, alloplastic augmentation as a single modality does not address certain specific sites, such as the tear trough, the skeletonized periorbital, and the inferior extension of the submalar hollowing into the lower third of the face. These represent potential areas where fillers can supplement treatment to achieve an improved long-lasting result. Moreover, fillers may be beneficial in overcoming potential challenges in the perceptual ability to correctly size implants and may ensure optimal volume restoration when conservatively choosing a smaller implant. Longevity in patient satisfaction and volume restoration can be enhanced with decreased amounts of filler during the postoperative period to improve site-specific areas. However, the extent and type

of volume loss contributed by both soft-tissue and skeletal changes must be evaluated individually for each patient to maximize the benefit of multiple treatment modalities.

Chin Augmentation

The goal of chin augmentation is to reposition and rotate a rigid soft-tissue envelope to a more projected position along the inferior border of the mandible. The procedure should optimally expand the chin in a three-dimensional plane while preserving the labiomental sulcus and increase the vertical dimension on the frontal view (**Fig. 1**).

Anatomically, the soft-tissue "chin button" is a dense structural entity that has limited mobility or ability to expand because of the following factors:

1. The amount of subcutaneous tissue between the deep dermis and underlying mentalis muscle is minimal.
2. The mentalis muscle is not only attached to the mandible but also intimately intertwined into the soft tissue of the chin.
3. The anterior mental and more lateral mandibulocutaneous ligaments hinder the leverage



Fig. 1. Chin implant increases vertical dimension by rotation of soft tissue anteriorly (A) and inferiorly (B).

necessary to expand and dissociate the soft-tissue envelope from underlying bone.

Therefore, treatment with either an alloplastic implant or filler must overcome these factors to improve the aesthetic outcome.¹ Fillers have traditionally been applied to improve a deep labimental sulcus, soften a peau d'orange deformity, and efface the prejowl sulcus.⁵ However, all 3 authors agree that because of the aforementioned anatomic inhibitory factors, the projection, rotation, and repositioning necessary for improving the aesthetics of the anterior chin cannot be accomplished with fillers alone.

DECISION ALGORITHM FOR SELECTING SURGICAL VERSUS NONSURGICAL OR LESS-INVASIVE APPROACHES FOR MIDFACE REJUVENATION

A thorough understanding of the aging face and accurate preoperative assessment can guide the surgeon in selecting the optimal treatment and avoiding undesirable aesthetic results. The treatment algorithm depends on each patient's needs,

which are dictated by the relative contributions of soft-tissue and skeletal deficiencies.

Filler Alone

In patients with mild to moderate soft-tissue volume loss and minimal midface skeletal volume loss, fillers or fat transfer alone can effectively rejuvenate the face (Fig. 2). In addition, fillers can successfully treat site-specific regions involving the tear trough and skeletonized periorbital, as well as mild to moderate inferiorly extended submalar hollowness (Fig. 3).

The patients in Figs. 2 and 3 were treated with poly-L-lactic acid (Sculptra) in multiple soft-tissue planes.

Dilution

The treating author's (J.J.) method includes diluting the product 1 day before injection.

- The dilution solution includes 7 mL of sterile water and 3 mL of 2% plain lidocaine.
- Once the product is diluted, it is warmed to 100°F to deter from the natural tendency of the product to aggregate on the day of injection.



Fig. 2. Before (A) and after (B) correction of moderate loss of soft-tissue volume using poly-L-lactic acid applied to the tear trough, inferior orbital rim, and midface hollow in a case with adequate skeletal structure.



Fig. 3. Patient with adequate skeletal development injected to the tear trough, inferior orbital rim, submalar hollow, and prejowl region before (A) and after (B) injection with poly-L-lactic acid.

Anesthesia

- Local anesthesia is administered at 2 injection sites: the first injection site is in the plane of the midpupillary line, and the second is slightly lateral to the lateral canthus.

Injection

- The injection sites are approximately at the junction of the thin eyelid skin and thicker midface skin.
- A 3-mL syringe and a 23-gauge (1.5 in) needle is then used for injecting the product beginning at the lateral canthus injection site.
- First, the product is injected in a submuscular/supraperiosteal plane along the inferior orbital rim in retrograde fashion.
- Next, the product is injected superiorly along the lower eyelid in a supramuscular plane to approximately 1 cm from the tarsal plate.
- The product is then massaged superiorly toward the tarsal plate to minimize the needle trauma to this area.
- Next, the needle is placed in the medial injection site and the same injection technique is used to fill the inferior orbital rim, medial lower eyelid.
- A total of 3 mL on each side is injected per session.
- The midface and tear trough region may be treated at the same time by injecting into the dermal-subcutaneous fat junction.

The average patient undergoes 3 sessions during a 4-month period. Patients tolerate the injection procedure with minimal discomfort when injecting in the correct plane.

Treatment of Various Patterns of Midface Deformities with Implants

Recognizing patterns of midface deformity is essential for selecting the optimal implant shape and size to obtain the best overall effects in facial contouring (**Table 1**).

Patients with type I deformities exhibit good midfacial fullness but have insufficient malar skeletal development. In these cases, a malar implant can augment the zygoma and create the appearance of a lateral-projecting cheek bone (**Fig. 4A**). The second deformity (type IIa) is characterized by atrophy of the midface soft tissue and adequate malar development. The submalar depression does not extend inferiorly past the inferior border of the zygoma into the lower third of the face

Table 1
Facial deformity types and recommended treatment approaches

	Deformity Type		Augmentation Required	Treatment Protocol
	Soft Tissue	Skeletal		
—	Mild to moderate loss	Adequate development	Subcutaneous tissue volume in site-specific areas	May use fillers or fat transfer for mild subcutaneous loss, tear trough, skeletonized infraorbital rim/periorbital (thin skin), Marionette lines, and nasolabial folds
Type I	Adequate volume	Malar hypoplasia	Projection over the malar eminence	Conform malar implant: "shell type" extending inferiorly into submalar space for improved contour Minimal amount of fillers or fat may be used adjunctively for asymmetry with sizing, tear trough, skeletonized intraorbital rim (thin skin), and subcutaneous loss
Type II (IIa/IIb)	Submalar volume deficiency (primarily in upper half of submalar triangle)	Adequate development	Requires anterior projection Implant placed over face of maxilla and/or masseter tendon in submalar space Provides midfacial fill	Conform submalar implant Filler or fat for site-specific areas including lower half of submalar triangle if necessary
Type III	Submalar volume deficiency	Malar hypoplasia	Requires anterior and lateral projection; "volume replacing implant" for entire midface restructuring	Combined midface implant (malar-submalar) Fills large midfacial void Fillers alone inadequate to create project necessary and may result in overfilling of product and amorphous facial contour Adjunctive fillers or fat may be used for site-specific areas and sizing issues

(type IIb). The implant must provide a midfacial projection. Type IIa deformities are treated with a conform submalar implant (see [Fig. 4B](#)). Type IIb is a subtype II deformity involving a subset of submalar depressions that extend into the lower third of the face. This condition is treated either with filler alone or with a submalar implant placed in the submalar deficiency, with filler or fat placed into the submalar extension lateral to the nasolabial and Marionette line. A third variation (type III deformity) arises from combined malar hypoplasia and midfacial soft-tissue volume loss (see [Fig. 4C](#)). In this deformity, described as the "volume-deficient face," a combined implant

(malar-submalar) or the new conform midfacial implant proportionally augments the deficient skeletal structure while filling the void created by midfacial volume loss ([Fig. 5](#)).

PATIENT SELECTION

The normal aging process commences between the third and fourth decades of life and rapidly accelerates through the fifth and sixth decades. This is consistent with Shaw's finding that statistically significant losses in skeletal volume occurred on average between the ages of 24.7 and 50.2 years.⁶ Although prospective candidates

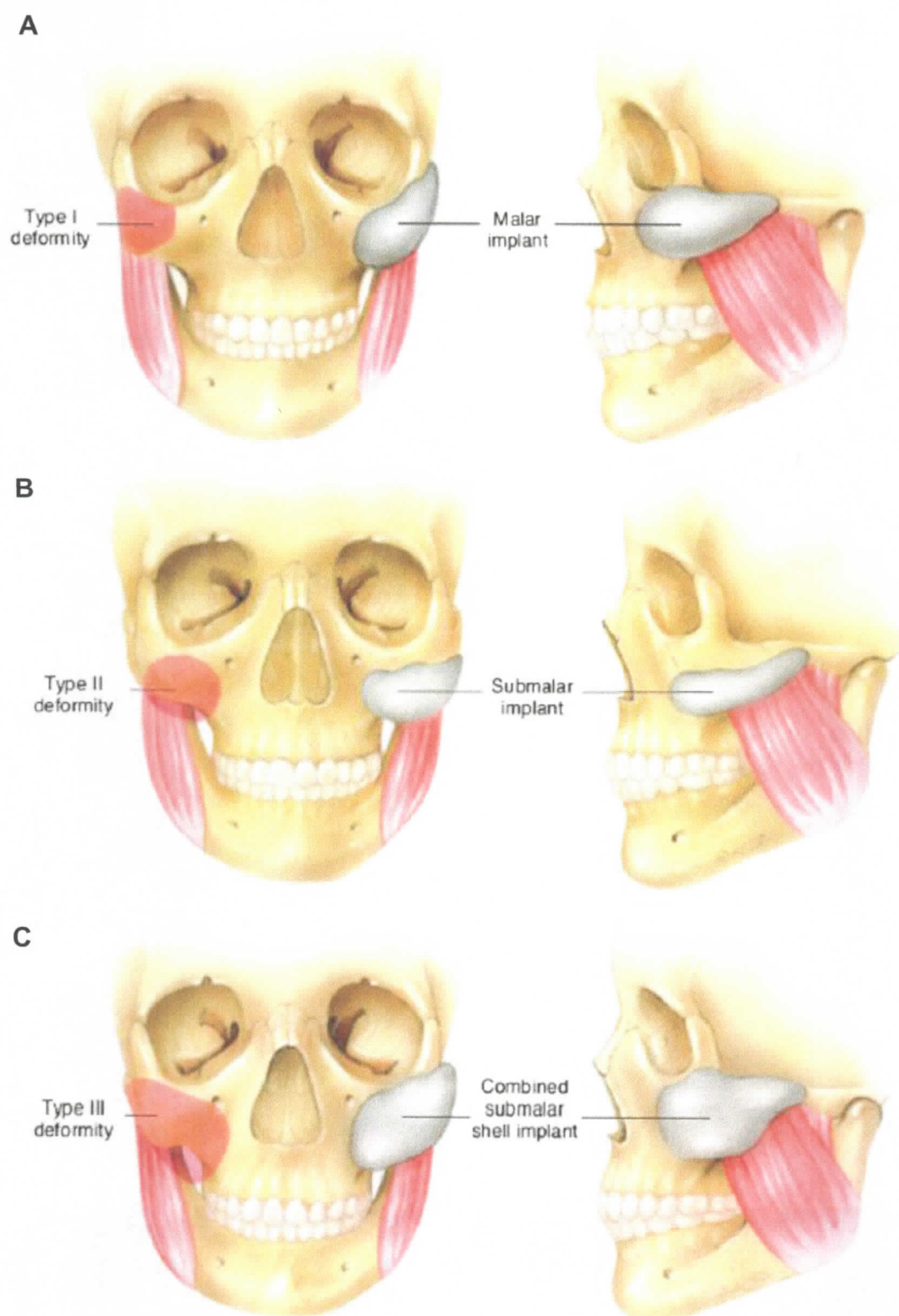


Fig. 4. Implant placement by facial deformity type. (A) In type I deformity, malar shell implants rest in a more superior and lateral position over the malar and zygomatic bone. (B) Submalar implants for type II deformity are situated over the anterior face of the maxilla. (C) For type III, combined malar-submalar implants 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.)



Fig. 5. Patient with soft-tissue and skeletal volume loss before (A) and after (B) treatment with alloplastic implantation of the midface.

typically present during the midlife or later years, the surgeon's ability to recognize structural and soft-tissue defects and alterations in anatomy plays a critical role in assessing a patient's eligibility for facial rejuvenation procedures. Before proceeding with any aesthetic procedure, assessing both the psychological status and medical condition of the patient is paramount. In addition, a thorough preoperative evaluation should address the patient's goals, management of expectations, and informed consent.

PREOPERATIVE PLANNING

Patients are instructed to withhold aspirin, nonsteroidal antiinflammatory drugs (NSAIDs), herbal supplements, and any other anticoagulant therapy for approximately 10 to 14 days.

PATIENT POSITIONING

- Markings are applied with the patient in the upright position before performing any rejuvenation technique.
- Facial fillers are typically injected in the upright to semirecumbent position.

- Implants are generally placed in an operating room setting, with the patient in a supine position.
- If the patient is intubated, it is important to avoid distorting the facial anatomy when securing the endotracheal tube to the face.

POTENTIAL COMPLICATIONS AND THEIR MANAGEMENT

Both traditional and minimally invasive approaches to facial rejuvenation can benefit from proper preoperative planning to minimize the risk of potential complications and maximize patient satisfaction. Overall, technique-dependent and patient-dependent variables can also contribute to the degree of expected complications. Early injection site reactions, including swelling, bruising, and erythema at the injection site, have been reported in more than 90% of subjects treated with soft-tissue fillers in clinical studies.¹⁴ However, in practice, the extent of superficial trauma depends on the gauge of the needle and viscosity of the filler; more viscous fillers requiring larger needles can lead to greater disruption of the dermal structures, with subsequent capillary leakage,

edema, and inflammation.¹⁴ In addition, the location of the injection may determine the extent of local trauma. For example, swelling and bruising can occur more frequently after injections of filler in highly vascular areas, such as the lip or tear trough sulcus. Typically, swelling and bruising after the injection of soft-tissue fillers can persist for 4 to 7 days but may be minimized by advising the patient to avoid aspirin, NSAIDs, and vitamin supplements for 7 to 10 days before the procedure. Hypersensitivity reactions to dermal fillers, particularly those containing bovine collagen, pose a theoretical risk but have been reported in the published literature.¹⁴ In addition to these potential complications, improper technique and/or injection of too little or too much filler can lead to undesirable aesthetic results or lack of longevity (Fig. 6). Migration and asymmetric resorption of tissue fillers may also occur (Fig. 7).

Catastrophic complications include vessel injury than can result in skin infarction and ultimately skin loss. These complications are minimized when injecting within the correct plane. Injections of poly-L-lactic acid (Sculptra) as described earlier to the periorbital and tear trough region may potentially present with nodule formation, which typically



Fig. 6. Injection of excessive volumes of filler into the medial aspect of the midface can result in overfilling of the midface and an amorphous facial contour.

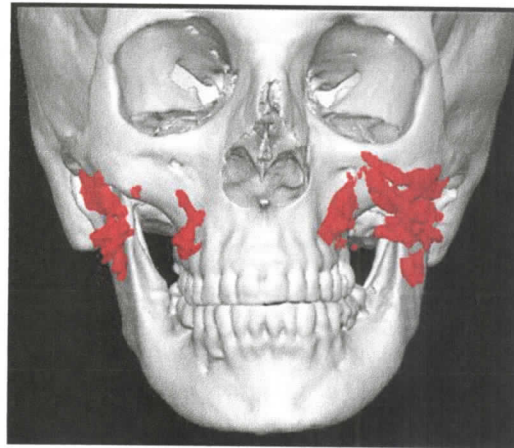


Fig. 7. Coronal computed tomographic image demonstrating calcium hydroxyapatite injected into the midface with migration and asymmetric resorption.

occurs in about 5% to 7% of the treated patients.⁹ When visible or palpable to the patient, the nodules may be injected intralesionally with an equal dilution of triamcinolone acetonide (Kenalog), 10 mg/mL, and 5 Fluorouracil. Injections are administered at 30- to 45-day intervals, and most nodules resolve. Surgical removal is not indicated for most cases.

Fat transfer, an acceptable method for remedying medial and central rim skeletonization, can also lead to complications. This approach gained popularity in the late 1990s and was championed by advocates such as Coleman.¹⁰ Long-term follow-up, however, revealed a great deal of variability in the amount of fat that remained viable after harvest and injection, leading to the need for multiple treatments. Moreover, complications such as persistent fat nodules or lumps along the orbital rim occurred postoperatively.¹⁵ Retained fat has also been found to preserve the donor site characteristics, which increases its volume independently and amorphously with substantial weight gain.^{16,17}

As with soft-tissue fillers, postoperative edema after implant placement is not uncommon. Approximately 80% to 85% of edema resolves within 3 to 4 weeks.⁹ Incorrect placement, insufficient pocket size, or inadequate fixation of the implant can cause malpositioning of the implant; however, the implant should not extrude if proper technique is followed. Other complications include bleeding, hematoma, seroma, fistula, pain, and persistent inflammatory action. Approximately 1% of patients receiving alloplastic silicone implants develop postoperative infections.¹⁶ Infraorbital and facial nerve injury may also occur but is rarely permanent.

POSTPROCEDURAL CARE AND RECOVERY

Fillers

Typically, no analgesics are prescribed for routine pain management in the postoperative period. The acute edema and erythema may be treated with ice packs for the first 24 hours. Follow-up care is scheduled for 7 days after the procedure. Patients are instructed to contact the treating physician if signs of vascular compromise or impending skin necrosis occur, such as extreme pain, superficial skin changes, fever, or expanding mass.

Implants

Facial implants are performed as an outpatient procedure, and patients usually recover at home. Antibiotics, analgesics, and antiemetics are prescribed, and patients are advised to apply ice packs for 3 to 4 days and to sleep, or rest, with the head elevated. The initial postoperative visit typically occurs on the first or second day and the facial dressings, external sutures, and drains are removed if applicable. Most patients resume routine activity as early as 5 to 7 days postoperatively.

PROCEDURAL APPROACHES

Fillers

The choice of filler used varies depending on the patients' specific needs and goals.

Hyaluronic acids are used for patients who want an immediate but reversible correction with hyaluronidase. Permanent fillers approved by the US Food and Drug Administration, such as polymethylmethacrylate (Artefill), can also be substituted for soft tissue, as well as for skeletal augmentation. However, once injected, it cannot be removed.

One of the authors (J.J.) often injects calcium hydroxyapatite supraperiosteally to augment deficiencies in the skeletal support structure and uses poly-L-lactic acid injected in the dermal-subcutaneous fat junction to replace lost soft tissue in the midface and tear trough. These fillers have biostimulatory properties and confer longer-lasting effects over hyaluronic acid fillers when used for these indications.

Midface Implantation

Surgical insertion of midface implants is a simple, straightforward procedure, which can be performed by an experienced surgeon in less than 30 minutes using intravenous sedation or general anesthesia. The implants are soaked in an antibiotic solution before insertion. During the operation, the surgeon should have access to

a variety of implant sizes and shapes and must be prepared to customize the implants if needed.

Chin Augmentation

Chin augmentation using alloplastic implants is a technically simple procedure that releases the anterior mental ligaments and allows for repositioning of the soft-tissue button to a more anterior and projected position. The implant is placed externally through a submental incision or via an intraoral incision along the inferior gingival sulcus. The implant procedure can generally be completed in less than 30 minutes.

The authors typically use the external route via a 1.0- to 1.5-cm submental incision. Technical and aesthetic advantages of the external approach include preservation of the labiomental sulcus by avoiding disruption of the mentalis muscle attachment to the mandible, avoidance of intraoral bacterial contamination, direct access to the mandibular border where the cortical bone is present, limited retraction of the mental nerve, the ability to easily detach the anterior ligamentous attachments near the submental incision site, and the ability to fixate the implant along the inferior mandibular border. Using either approach, however, the surgeon must maintain dissection directly on bone in a subperiosteal plane to create a firm, secure attachment of the implant to the bony skeleton. One may find a condensation of fibrous attachments just lateral to the midline of the mentum. It is often necessary to incise and detach these tendinous attachments to allow dissection to continue along the inferior segment of the mandible. Failure to recognize these attachments may direct the lateral plane of dissection superiorly, placing the mental nerve at risk. Continued dissection laterally also provides an exponential benefit by elevating the deep periosteal attachments of the mandibulocutaneous ligament.

COMPARISON OF TRADITIONAL VERSUS MINIMALLY INVASIVE SURGICAL APPROACHES

Published studies indicate that malar augmentation with fillers can also enhance the upper cheek by secondarily lifting and elevating parts of the lower face. Theoretically, the volume of filler placed into the midface augments and elevates the soft tissue in an anterior-posterior plane. One study of midface hyaluronic acid augmentation used an average volume of 3.9 mL in 72 patients (mean age, 43.6 years) and demonstrated satisfactory results lasting from 4 to 64 weeks

(approximately 1–16 months). Midface volume enhancement in cases with ample skeletal structure may in fact elevate the lower third of the face; however, as facial skeletal volume decreases during midlife, augmentation of the soft-tissue plane without skeletal foundation does not allow for adequate suspension of the face and, thus, is more susceptible to gravitational forces. This change produces a deeper nasolabial fold and jowl, as well as aggregation of fillers in dependent areas, and can produce an amorphous facial contour (see Fig. 6).

On the other hand, implantation can offer a permanent, more durable option that is completely reversible, and the implant can be removed and replaced under local anesthesia with minimal dissection. Collectively, these benefits make midface augmentation with implants an attractive option for enhancing volume over the long term. This technique also requires a substantially less amount of filler for rejuvenating the aging face over a protracted period.

CONCLUSION ON VOLUMIZING THE FACE

Minimally invasive and facial implantation techniques are safe, effective options for volumizing the aging midface and chin. Achieving the optimal aesthetic result requires an understanding of the multidimensional aging process involving the skin, deep soft tissue, and facial skeleton. Fillers have proved to be a noninvasive option for fine rhytids, nasolabial folds, prejowl sulcus, and the labiomental crease. In addition, facial fillers can also be used for facial contouring in patients with minimal facial bone resorption to achieve midface rejuvenation.

However, the role of alloplastic implantation as a sole modality or in conjunction with either other surgical procedures or minimally invasive soft-tissue augmentation techniques must be considered during the preoperative consultation for both midface aesthetic contour enhancement and facial rejuvenation in patients with skeletal volume resorption. Although chin augmentation with alloplastic implants remains the optimal treatment modality available, using alloplastic implants in combination with minimally invasive approaches may allow the surgeon to address multiple anatomic deficiencies and can promote greater customization of facial rejuvenation techniques.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at <http://dx.doi.org/10.1016/j.fsc.2013.02.001>.

REFERENCES

1. Binder WJ, Kemer FM, Parkes ML. Mentoplasty – a clinical analysis of alloplastic implants. *Laryngoscope* 1981;91(3):383–91.
2. Binder WJ. Submalar augmentation. An alternative to face-lift surgery. *Arch Otolaryngol Head Neck Surg* 1989;115(7):797–801.
3. American Society of Plastic Surgeons. 2012 Press Release. New ASPS statistics show “chinplants” are fastest growing procedure. Available at: <http://www.plasticsurgery.org/News-and-Resources/Press-Release-Archives/2012-Press-Release-Archives/Chin-Surgery-Skyrockets-Among-Women-and-Men.html>. Accessed October 1, 2012.
4. Stallworth CL, Wang TD. Fat grafting of the midface. *Facial Plast Surg* 2010;26(5):369–75.
5. Lowe NJ, Grover R. Injectable hyaluronic acid implant for malar and mental enhancement. *Dermatol Surg* 2006;32:881–5.
6. Shaw RB, Katzel EB, Koltz PF, et al. Aging of the facial skeleton: aesthetic implications and rejuvenation strategies. *Plast Reconstr Surg* 2010;127(1):374–83.
7. Kahn DM, Shaw RB. Overview of current thoughts on facial volume and aging. *Facial Plast Surg* 2010;26:350–5.
8. Binder WJ. Facial rejuvenation and volumization using implants. *Facial Plast Surg* 2011;27:86–97.
9. Schierle CF, Casas LA. Nonsurgical rejuvenation of the aging face with injectable poly-L-lactic acid for restoration of soft tissue volume. *Aesthet Surg J* 2011;31(1):95–109.
10. Hopping SB, Joshi AS, Tanna N, et al. Volumetric facelift: evaluation of rhytidectomy with alloplastic augmentation. *Ann Otol Rhinol Laryngol* 2010;119(3):174–80.
11. Coleman SR. Long-term survival of fat transplants. *Aesthetic Plast Surg* 1995;19(5):421–5.
12. Lambros V. Fat contouring in the face and neck. *Clin Plast Surg* 1992;19:401.
13. Kim JJ, Evans GR. Applications of biomaterials in plastic surgery. *Clin Plast Surg* 2012;39(4):359–76.
14. Andre P. New trends in face rejuvenation by hyaluronic acid injections. *J Cosmet Dermatol* 2008;7:251–8.
15. Cox SE, Adigun CG. Complications of injectable fillers and neurotoxins. *Dermatol Ther* 2011;24:524–36.
16. Kranendock S, Obagi S. Autologous fat transfer for periorbital rejuvenation: indications, technique, and complications. *Dermatol Surg* 2007;33(5):572–8.
17. Rubin JP, Yaremchuk MJ. Complications and toxicities of implantable biomaterials used in facial reconstructive and aesthetic surgery: a comprehensive review of the literature. *Plast Reconstr Surg* 1997;100(5):1336–53.