

# Facial Dermal Fillers: Selection of Appropriate Products and Techniques

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Over the last decade, there has been a shift in the way aesthetic surgeons approach facial rejuvenation. With recognition of the value of volume enhancement in achieving a more youthful appearance, as well as the ease of office procedures offering minimal downtime and predictable results, there has been a concomitant explosion in the soft tissue filler market. Given the vast array of filler products currently available, the decision of which facial filler to use in specific situations can be complicated and confusing. A physician's selection of facial filler(s) should be based on a solid understanding of the various filler products, appropriate patient selection, and the physician's proficiency in injection techniques. We present a review of the most widely used fillers, offering guidance on patient selection and effective injection techniques. (*Aesthetic Surg J* 2008;28:335-347)

With the millennium came a conceptual shift in the approach to facial rejuvenation, from subtractive surgical methods toward additive volume restoration techniques. Understanding the importance of volume loss to aging features has recalibrated the manner in which the maturing face is treated. While surgical intervention remains vital, replenishing volume to attain a more youthful appearance is at the forefront of aesthetic science. Facial fillers, injectable therapeutic materials for soft tissue augmentation, are an ideal way of restoring facial volume and contour. Facial fillers appeal to a broad spectrum of patients, from those seeking minimal cosmetic enhancement to those seeking an effective complement to facial surgery. As such, facial filler injections are some of the most commonly performed cosmetic procedures.<sup>1</sup> With injectable product features including convenient office treatments; quick, reliable results; and minimal downtime, there has been an explosion in the number of commercially available fillers. While many filler materials have shown promise, others have been disregarded or even criminalized. Considering the numerous filler types and brands currently available in the United States and worldwide, deciding which facial filler to use, when to use it and why, can be a complex process. With a solid understanding of filler products, appropriate filler selection, prudent patient selection, and proper injection techniques, the aesthetic surgeon can expect satisfied patients with effective volume correction. Here, we will review the biology of the leading filler compounds and the components of successful filler treatments, including product selection and injection techniques.

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## FACIAL FILLERS AND THE AGING PROCESS

During the aging process, the face loses fat and volume while the skin loses collagen and elasticity.<sup>2</sup> Accentuated by full cheeks and curves in youth, the aging face becomes framed by bony contours wrapped with thin skin, lending a deflated and fallen appearance (Figure 1).

Understanding the aging process is crucial to attaining optimal results with facial rejuvenation procedures. For those with thin skin and volume loss, tightly retracting the facial skin through surgical intervention may not be the best treatment.

Performance of an inappropriate surgical procedure may produce an artificial-looking, "wind tunnel" appearance. Replenishing facial volume or augmenting a surgical procedure with filler technologies would be a better approach in these patients. The placement of injectable fillers in the treatment of lines, wrinkles, and areas of volume depletion can achieve excellent aesthetic results with limited or no downtime and without the potential morbidity of surgery.

## Selecting the Most Appropriate Filler

A wide variety of filler materials and brands are currently available, with a seemingly endless flow of new and emerging products (Table 1). But many of the "latest and greatest" products do not prove to be safe or effective, and they eventually fall by the wayside. Sometimes it is only after the products have been in the marketplace for months to years, and after many patients have been treated, that physicians come to the realization that the products have failed to deliver the anticipated results. Understanding the biology of current filler compounds that have been approved by the U.S. Food and Drug Administration (FDA) facilitates the best treatment selection. We include silicone in our discussion, although its



**Figure 1.** The aging face has lost volume and skin elasticity.

cosmetic use is off-label, because of its history as a filling agent and the continued interest of some physicians in its potential as an effective treatment.

## PRODUCTS

### Hyaluronic Acids

Of the available hyaluronic acid (HA) fillers, Restylane (Medicis, Scottsdale, AZ) was the first to receive approval by the FDA (in December 2003) for the correction of moderate to severe facial wrinkles and folds, such as nasolabial folds.<sup>3</sup> In a study by Narins et al,<sup>4</sup> Restylane was found to be superior to Zyplast (Inamed Aesthetics, Santa Barbara, CA) in 60% of patients 6 months posttreatment with a smaller volume of Restylane required to reach full correction as compared with Zyplast. Other HA fillers currently approved by the FDA for cosmetic use include Captique (Allergan Inc, Irvine, CA), Juvederm (Allergan), and the animal-derived Hylaform (Allergan). Restylane has an HA concentration of 20 mg/mL with a particle size of 400  $\mu\text{m}$ ,<sup>3</sup> making it a more viscous product than the FDA-approved animal-derived HA with 6 mg/mL HA. It had originally been postulated that Restylane's physical volume was the sole cause for the volumetric improvement. However, a recent study revealed that Restylane operates as an effective dermal filler by physically stretching dermal fibroblasts, which induces *de novo* collagen formation while inhibiting the breakdown of existing collagen.<sup>5</sup> These data contribute to anecdotal reports of a cumulative Restylane effect in which subsequent treatments require less material than initial treatments to achieve the desired soft tissue correction.

Juvederm, a similar non-animal-based HA with a slightly higher concentration of HA (24 mg/mL) and

more extensive cross-linking, was approved by the FDA in June 2006. The additional cross-linking is thought to increase longevity, and recent reports have shown this product to persist up to 12 months.<sup>6</sup> Whereas the HA particles in Restylane are uniformly shaped, Juvederm particles are randomly shaped. This is postulated to be responsible for Juvederm's smooth gel-like consistency. Some physicians describe this product as flowing from the syringe with more ease and fluidity and causing less bruising. Much like the rivalry between Coke and Pepsi, there are those who prefer the alternate brand. Additionally, Juvederm was approved by the FDA in thinner (Ultra) and thicker (Ultra Plus) versions for greater injection subtlety and variety. With greater particle size and a slightly higher percentage of cross-linking than Ultra, Juvederm Ultra Plus is designated for deeper, volumizing injections.

Perlane (QMed, Eatontown, NJ), a thicker, larger-particle version of Restylane, was approved by the FDA in January 2007. Perlane differs from Restylane only in its particle size (940 vs 1090  $\mu\text{m}$ ), although the concentration of HA remains constant in both products (20 mg/mL).<sup>7</sup> As larger particle size suspensions, Perlane and Juvederm Ultra Plus have less total surface area subject to attack by the body, and are theoretically more resistant to degradation. Because these products are thicker, Juvederm Ultra Plus and Perlane are designed to be injected deeper into the dermis or subdermis for volume correction and contouring capabilities.

The hydrophilic nature of HA allows it to maintain its shape using the body's own moisture. One gram of HA can bind up to 6 L of water.<sup>8</sup> As a component of the extracellular matrix, intrinsic HA functions include space filling, lubrication, shock absorption, and protein exclusion. Over time, the injected hyaluronic gel is slowly absorbed by the surrounding tissues and disappears by a process called isovolumetric degradation.<sup>9</sup> As the HA gradually degrades, each molecule binds more water and, eventually, the same volume can be maintained with less HA. This provides a natural appearing volume correction and cosmetic persistence until the product is almost completely degraded.

The chemical and molecular composition of natural HA is conserved throughout all living organisms; therefore, HA fillers do not possess species or tissue specificity. This means that there is a negligible potential of eliciting humoral or cell-mediated immune reactions. Restylane, Perlane, and Juvederm are HA dermal fillers derived from bacterial fermentation in cultures of a *Streptococcus* species. Because these products are not of animal origin, there is almost no risk of contamination with animal allergens, pathogens, or xenogenic disease during the manufacturing process.<sup>10</sup> Restylane, Perlane, and Juvederm lead the market in HA fillers. Other HAs have not demonstrated similar longevity or reliability and are rarely used. Predictable and natural results coupled with minimal risk and downtime have contributed significantly to their growing worldwide popularity.

**Table 1.** Facial fillers

Filler	Function	Uses	Pros	Cons	Comments
Collagen-based products (Cosmoderm and Cosmoplast)	Human-derived, bioengineered collagen injected to fill facial wrinkles	Anywhere; effective contouring agent (lips, fine etched lines)	Immediate results with no downtime; formulated with lidocaine for patient comfort	Limited longevity (lasts 3 months)	An FDA-approved collagen dermal filler that does not require a skin test
Hyaluronic acid (Restylane, Perlane, Juvederm, Cptique)	Non-animal-derived hyaluronic acid engineered to resist degradation for wrinkle filler and volume replacement	Volume and contouring (periorbital, nasolabial, lips, cheeks, etc.)	Results are immediate and last 6–18 months; reversible	May be visible or palpated if injected superficially; less effective for treating lipoatrophy or very large volume correction	Stimulates de novo collagen formation; FDA-approved for filling moderate to severe wrinkles around the nose and mouth; all other uses considered off-label; no risk of animal-based disease transmission
Calcium hydroxylapatite (Radiesse)	Microspheres of calcium hydroxylapatite inducing production of collagen	Volume enhancer (nasolabial and cheeks)	Biocompatible and ultimately biodegradable; long-lasting (12 months and maybe beyond); moldable	Clumping, lumping, and nodules can appear when injected into the lips	Do NOT use Radiesse in the lips; FDA-approved for facial lipoatrophy and moderate-to-severe wrinkles around the mouth
Poly-L-lactic acid (Sculptra and New Fill)	Synthetic material is injected into the face, causing body to produce its own collagen	Volume enhancer (nasolabial, cheeks, and temples)	Long-lasting (18–24 mos)	Results not immediate, may require multiple treatments; skin nodules and granulomatous reactions possible	In a clinical study of Sculptra, the treatment results lasted for up to 2 years after the first treatment session; FDA-approved for facial lipoatrophy
Fat transfer	Fat cells are harvested from one part of the body and injected into the face to replenish volume	Volume augmentation (cheeks, periorbital, and temple); not used for finer contouring	Most natural filler; fat can be stored for touch-ups	For volume replacement, less effective at finer contouring; duration is unpredictable: 6 months–10 yrs	“Predictably unpredictable”
Silicone (Silikon 1000 and Adaptosil 5000)	Highly refined silicone oil is injected using microdroplet technique	Volume replacement and contouring	Permanent	Cannot be removed after being injected	Beware of black market non-medical silicone; off-label cosmetic use
Polymethylmethacrylate (PMMA; Artecoll and Artefill)	PMMA microspheres surrounded by collagen	FDA-approved for nasolabial folds, deep wrinkles	Permanent	Numerous injections needed for volume; allergic reactions possible; requires 3 months for full effects; sometimes visible under skin	Because of the bovine collagen component, allergy skin testing is required; PMMA does not break down

FDA, U.S. Food and Drug Administration.

Adaptosil 5000 is manufactured by Bausch Lomb (Rochester, NY). Artecoll is manufactured by Artes (San Diego, CA). Cptique, Cosmoderm, Cosmoplast, Hylaform, and Juvederm are manufactured by Allergan, Inc (Irvine, CA). New Fill is manufactured by Ashford Aesthetics (Brussels, Belgium). Perlane is manufactured by QMed (Eatontown, NJ). Radiesse is manufactured by Bioform Medical (San Mateo, CA). Restylane is manufactured by Medicis (Scottsdale, AZ). Sculptra is manufactured by Sanofi-Aventis (Bridgewater, NJ). Silikon 1000 is manufactured by Alcon (Fort Worth, TX). Zylplast is manufactured by Inamed Aesthetics (Santa Barbara, CA).

## Calcium Hydroxylapatite

Radiesse (Bioform Medical, San Mateo, CA) was approved by the FDA in December 2006 for the correction of facial wrinkles and folds, such as nasolabial folds, and for the correction of facial lipoatrophy associated with HIV. Radiesse is composed of calcium hydroxylapatite (CaHA) microspheres (25–45  $\mu\text{m}$ ) surrounded by a 70% methylcellulose carrier that dissipates quickly in vivo, leaving the CaHA microsphere as a scaffolding to promote collagen in-growth.<sup>11</sup> Radiesse has a good safety record and stimulates only minimal foreign body reaction secondary to the spherical shape of the product, which incites less inflammation than an irregularly shaped product.<sup>12,13</sup> Granulomatous reactions and migration of the product are unlikely.<sup>14</sup> The calcium and phosphate minerals comprising Radiesse microspheres are the same as found in bone. While there was an initial discussion about potential osteoneogenesis after injection, these concerns have been demonstrated as unfounded<sup>15</sup> because osteoneogenesis has never been reported in more than 6 years of clinical use. The product is faintly visible on radiographs but has not been reported to obscure radiographic interpretation. After implantation, this product is slightly more malleable than HA. Additionally, the same volume goes further, because a lower volume of CaHA is needed to fill the same defect as compared with HA. Importantly, CaHA is not recommended for lip augmentation, because an unacceptable number of labial nodules have been reported from the product clumping together.<sup>16</sup>

## Collagen-Based Products

Cosmoderm and Cosmoplast (Allergan) are human-derived, bioengineered collagen implants from a single cell line of fibroblasts screened for viral and bacterial pathogens. Approved by the FDA in March 2003, these products have a limited and waning role in the filler market. Because these products are of human origin, allergy skin testing is not required. Both of these injectable products are packaged with lidocaine (to provide anesthesia), making regional nerve blocks generally unnecessary. Although rare, complications with collagen injections have been reported, including vascular necrosis following glabellar collagen injections.<sup>17,18</sup> However, the most significant issues with collagen products have been their lack of longevity and their potential for a bumpy, irregular outcome. A new porcine-based collagen product called Evolence (ColbarLife Sciences, Herzliya, Israel) may help to restore collagen's reputation in the filler market. With results lasting up to 18 months in 66% of treated patients,<sup>19</sup> Evolence is anticipated to receive approval by the FDA in the near future.

## Silicone

While silicone is not currently approved for cosmetic use by the FDA, it is used by some practitioners nevertheless. Silicone has a history shrouded in controversy.<sup>20</sup> Currently, the 2 brands most commonly used off-label are

Silikon 1000 (Alcon, Fort Worth, TX) and Adaptosil 5000 (Bausch Lomb, Rochester, NY). Both of these products are approved by the FDA for ophthalmic use, but have been injected for soft tissue cosmetic augmentation. The centisokes (Cs) designation of the silicone preparations refers to the compound's viscosity. A Cs of 1000 is highly viscous and can be difficult to depress through a 30-gauge needle (by comparison, water has a viscosity of 100 Cs). Reports of serious and troubling complications after cosmetic silicone injections include granulomas, surface deformities, lymph vessel blockage, rosacea-like reaction, delayed hypersensitivity, migration, embolism, and blindness.<sup>21–25</sup> However, severe complications may be mostly avoided if pure silicone, as opposed to adulterated versions, is used with proper technique and indications.<sup>26</sup> Some practitioners have reported long-term effective and safe experiences with silicone.<sup>27–29</sup> Silicone injections are very technique-sensitive and require deep product placement. Overly superficial injections may result in excessive fibrosis, nodules, ridging, beading, and hypertrophic scar-like elevations.<sup>30</sup> A serial droplet injection technique may provide the best aesthetic results for correcting fine lines, wrinkles, and acne scarring with silicone. Undercorrection with multiple treatments spaced 2 to 3 months apart is recommended, because the injected silicone droplets continue to be coated with the patient's own collagen for up to 3 months.<sup>26</sup> The technique of microdroplets allows a monocellular fibrotic capsule to encompass each silicone particle, creating a microparticle. The collagen coating of the microparticles prevents migration and allows for a stable implant with permanent results.<sup>31</sup> However, uncertain long-term risks remain a concern with silicone injections.

## Polymethylmethacrylate

A novel filler agent approved by the FDA for cosmetic use in January 2007 was originally marketed as Artecoll (Artes, San Diego, CA) in Europe and Canada and is now approved in the United States as Artefill. Artefill is comprised of smooth round polymethylmethacrylate (PMMA) microspheres (30 to 42  $\mu\text{m}$  diameter) surrounded by bovine collagen. Because of the bovine collagen component, allergy skin testing is required before correction.<sup>32</sup> The PMMA spheres provide permanent correction, because the bovine collagen is replaced within 3 months by host connective tissue. After 7 months, it has been demonstrated that there are very few differences between the collagen fibers around the implant and those of the surrounding connective tissue.<sup>33</sup> Patient satisfaction outcomes have been favorable, with one study reporting high levels of patient satisfaction (89%).<sup>34</sup> The complication rate was 7%, with nodule formation in the lip the most commonly reported issue.<sup>35</sup> It is crucial to bear in mind that Artecoll/Artefill results are permanent and are therefore exquisitely technique-sensitive. Multiple treatments are prudent, with extra care being taken in placement of the product in or around the lips, where nodule forma-



**Figure 2.** Granulomatous reaction 12 months after 3 poly-L-lactic acid treatments.

tion is more likely. Appropriate patient selection and injection techniques are of paramount importance when injecting any permanent filler products.

### **Poly-L-lactic acid**

The poly-L-lactic acid Sculptra (PLLA; Sanofi-Aventis, Bridgewater NJ) provides a semipermanent correction and was approved by the FDA in 2004 for use in HIV facial lipoatrophy. Sculptra works by providing a volumizing effect with results lasting up to 2 years after the first treatment, but with multiple treatments often needed to achieve complete correction. As a major component of Vicryl suture (Ethicon Inc, Sommerville NJ), PLLA was formulated into an injectable filler and marketed under the name “New Fill” in Europe in 1999. The 40 to 63  $\mu\text{m}$  PLLA particles are suspended in a sodium oxymethylcellulose carrier. Histologically, Sculptra causes formation of microscopic nodules of multinucleated giant cells in the subcutaneous tissues.<sup>11</sup> Unlike HA fillers, the effects of PLLA are gradually achieved as Sculptra induces an expansion of dermal thickness. The substance is degraded by conversion to lactic acid monomers that are subsequently metabolized to glucose and  $\text{CO}_2$ .<sup>36,37</sup> Before approval by the FDA, studies in the HIV population revealed good results, documenting increased skin thickness with visible improvement in the signs of facial lipoatrophy.<sup>36,38,39</sup> Adverse events include palpable but nonvisible nodules that can be effectively dissipated with daily massage.<sup>40</sup> Concerns over delayed-type hypersensitivity reactions occurring months following injections<sup>41</sup> may be hindering its widespread acceptance as a cosmetic agent (Figure 2). Overall, the delayed results, pain on injection, and high price contribute to a product that is not as “user-friendly” as some of the other materials used for HIV lipoatrophy and aesthetic correction.

### **Fat Transfer**

As a usually abundant substance with no risk for immunologic rejection, fat is traditionally noted for its unreliable persistency. However, recent advancements in preparation, harvesting, and injection techniques provide for longer lasting and more predictable results.<sup>42–45</sup> A patient’s own fat is an ideal volume source because there are no allergic reac-

tions, it is readily available, relatively inexpensive, and can be used to effectively augment facial volume. Fat transfer as a volume correction technique is becoming an increasingly popular method among many cosmetic physicians for achieving a natural appearing facial rejuvenation, especially when performed simultaneously with a surgical procedure. However, fat transfer can also be performed in the office.

Substantial skill and experience are necessary to achieve good and consistent results with fat transfer. If used well, fat is an excellent filler material; however, the results of fat transfer remain predictably unpredictable, lasting from 6 months to 10 years. Repeat injections of stored, initially harvested fat may be necessary to maintain the desired fullness of the treated areas.

### **PATIENT EVALUATION AND SELECTION**

The choice of which filler to use and when to use it is primarily dependent on the patient rather than the product. Astute patient selection exponentially enhances aesthetic results and patient satisfaction. The following are some important questions to consider when determining which filler to use.

**What has or has not made the patient happy in the past?** If a patient has been pleased with their current filler regimen, there is no reason to change the filler unless there is significant cosmetic or safety advantage to using a different product. It is not recommended to re-administer a product with which the patient has been previously dissatisfied. In this situation, it is best to attempt an alternate treatment or product or simply not to retreat at all. Realistic patient expectations are paramount to all successful injection procedures.

**Does the patient demand either permanent or reversible products?** Certain patients insist on treatment with a permanent filler although a temporary filler may be the more judicious recommendation. If the patient is an appropriate candidate with significant temporary filler experience, a permanent filler may be an option. In contrast, patients new to filler therapy are best treated with reversible, nonpermanent agents. As such, the patient and physician have flexibility in terms of treatment volume, repetition, reversibility, and ability to modify and customize the outcome as needed.



**Figure 3.** **A.** Pretreatment view of a 57-year-old woman. **B.** Posttreatment view 8 weeks following collagen placement into the fine radial rhytids of the upper lip, providing a limited but successful correction of the fine lines.

**Can the patient tolerate downtime?** Patients who cannot tolerate excess posttreatment downtime are not ideal candidates for larger semipermanent volumizer and fat transfer procedures. These treatments are placed deeper in the dermis with larger-gauge needles and can result in more significant bruising and swelling. For patients who require rapid recovery, the thinner HA products or even collagen based products may be better choices.

**Is the patient undergoing simultaneous surgery?** For the patient who is undergoing surgery simultaneously, fat transfer is often an excellent option. It is abundant and easy to harvest while the patient is under anesthesia. A sterile controlled environment is assured. Additionally, fat transfer usually involves more downtime than the off-the-shelf injectable products and most patients undergoing surgery are expecting at least a week of recovery time.

**Is the patient older?** Older people tend to have a minimized immune response to a foreign body injection. Therefore, a permanent product, which may cause an intense inflammatory response in a younger patient, is more appropriately offered to an older person. Additionally, in the event of a complication requiring skin excision of the permanent product, it is easier to camouflage a scar in the expected creases of an older patient's face than in the mildly blemished to unblemished thicker skin of a younger patient.

**Is the patient's skin thick or thin?** Thick skin tends to better accept the deep semipermanent volumizers, resulting in a better outcome and greater longevity. Thin skin can appear lumpy when injected with thicker HA products. Often, a customized treatment using 2 or 3 different products on the same patient in different areas can achieve optimal correction.

### **FILLER SELECTION AND PLACEMENT BASED ON ANATOMIC REGION OR DEFECT**

The goal is to find the best match for the patients' problem with the optimal choice of filler therapy. Astute diagnostic skills, combined with an in-depth understanding of filler materials and their properties, will yield successful treatment outcomes.

### **Fine Etched Lines: Cosmoderm and Silicone**

To erase fine, superficially etched facial lines, a product that can be placed superficially and not show through the skin is best. The consistency of collagen-based products makes them an excellent treatment for this circumstance (Figure 3). Unfortunately, their longevity (8 to 12 weeks), is not ideal. In experienced hands, silicone injections can achieve excellent aesthetic results (Figure 4). However, these permanent results are balanced against the risk of delayed hypersensitivity reactions and increased complications.<sup>46</sup> As such, silicone treatments are best limited to older patients with previous experience with injectables. Importantly, as mentioned earlier, use of liquid silicone for cosmetic purposes is currently off-label.

### **Superficial Facial Lines and Creases: Restylane and Juvederm Ultra**

For medium-depth fine lines and creases, HA products can achieve excellent results. The product is placed just beneath the dermis to provide lasting and predictable results. When treating superficially, make sure the product is placed in the deep dermis. Superficial placement may be visible through the skin, worsening the patient's appearance.

### **Deeper Facial Lines, Folds, and Creases: Perlane, Juvederm Ultra Plus, Radiesse, and Fat**

For deeper lines and creases, the more robust volumizers, such as the larger particle HAs and CaHA, can effectively fill deeper facial lines and crevices. These products are injected deep in the dermis or subdermis to fill the defect completely (Figure 5).

### **Lip Augmentation: Restylane and Juvederm**

Successful lip augmentation requires significant skill and aesthetic expertise. One author uses thinner HAs to define the vermilion border and lift the oral commissure (Figure 6). Larger volumizing HAs can be used for creating a full pouty lip.

### **Periorbital Treatments: Juvederm and Restylane**

Thinner and conservative deposition of HA in the periorbital region can achieve a satisfactory result in appropri-



**Figure 4.** **A**, Pretreatment view of a 67-year-old woman. **B**, Posttreatment view following 2 silicone treatments (separated by 8 weeks) to the upper lip rhytids.



**Figure 5.** **A**, Pretreatment view of a 55-year-old woman. **B**, Posttreatment view 3 months after complete correction with calcium hydroxylapatite to nasolabial folds and prejowl sulcus.

ate patients (Figure 7).<sup>47</sup> Unfortunately, this treatment is often administered to a poorly selected patient and in excessive or inadequate volumes. Undertreatment and deep placement are important to achieving a good result in the periorbital region. Patients with thick skin, significant cheek pad ptosis, hollowing out of the infraorbital rim/nasojugal groove, and minimal pseudoherniation of orbital fat are the best candidates. Effective periorbital treatment is achieved by placing no more than 0.25 mL filler per side, injecting deep along the orbital rim in a serial depot manner. Fortunately, if the results are not acceptable, the volume augmenting effects of HA can be reversed by injecting 15 to 20 units of hyaluronidase (Amphadase; Amphastar Pharmaceuticals, Rancho Cucamonga, CA) or Vitrase (Ista Pharmaceuticals, Irvine, CA) into the overcorrected area.<sup>48</sup>

#### **Midface and Lower Face Volume Enhancement: Radiesse, Perlane, Juvederm Ultra Plus, and Fat**

These products nicely replace volume in the midface, cheeks, and prejowl sulcus (Figure 8). Newer intraoral injection techniques greatly decrease pain, posttreatment ecchymoses, and edema (Figure 9). The product is placed deeply in the subcutaneous tissues and along the supraperiosteal plane. After injection, the product is manually molded to

achieve the desired contour. Large volumes of product are necessary in order to appreciate the enhancement.

#### **ANESTHESIA FOR FILLER TREATMENTS**

Anesthesia is essential for most patients undergoing filler treatments; only rarely does a patient not require it. The type of anesthesia, whether a local nerve block or a topical anesthetic, is chosen according to the area to be treated and the pain threshold level of the patient. Pain perception is also location-dependent; for example, the lip area is very sensitive, and a local nerve block is almost always required while treatment under the eyes is barely felt with a sharp, thin needle and a topical anesthetic.

#### **Topical Anesthetics**

Topical anesthetics are commonly comprised of beta-caine, lidocaine, and tetracaine in various combinations. Many pharmacies will compound the products to a higher concentration than what is available over the counter. ELA Max (Ferndale Laboratories, Ferndale, MI) is available over the counter.

#### **Icing**

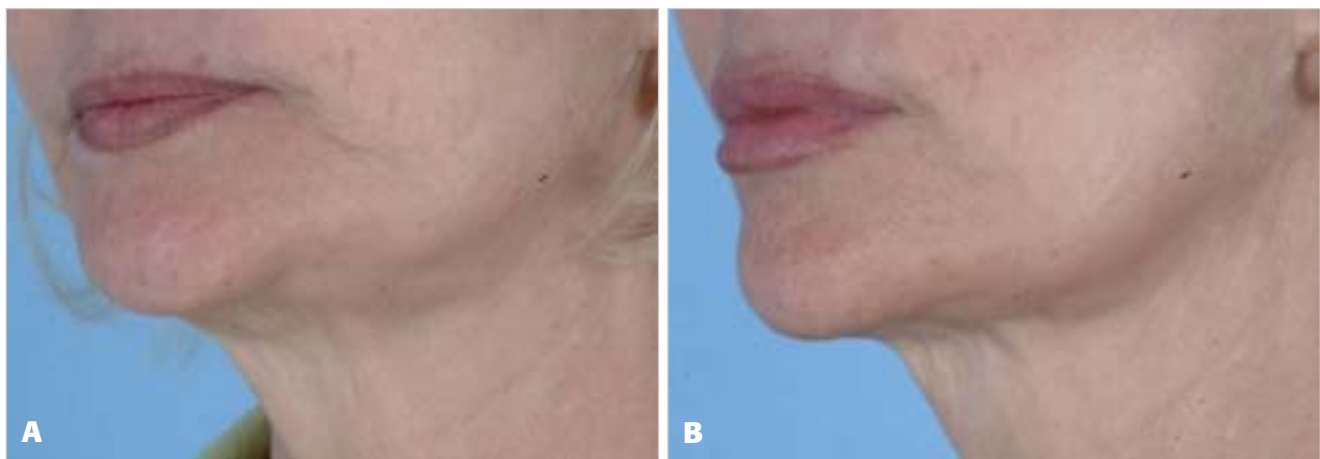
Icing is a low cost, easy, and safe method for blunting the pain response. Some pain will still be felt during the



**Figure 6.** **A**, Pretreatment view of a 51-year-old woman. **B**, Posttreatment view 13 months after HA placement in lips. **C**, Placement of hyaluronic acid into vermilion border.



**Figure 7.** **A**, Pretreatment view of a 52-year-old woman demonstrating infraorbital hollow accentuated by aging. **B**, Posttreatment view 6 months after placement of hyaluronic acid into infraorbital hollows.



**Figure 8.** **A**, Pretreatment view of a 58-year-old woman demonstrates a prominent prejowl sulcus depression. **B**, Posttreatment view 2 months after large-particle hyaluronic acid placed deeply into prejowl sulcus.

filler injection despite the precooling, but patients may prefer this method to a medicated anesthetic. Placing an ice cube or two in a clean surgical glove and then allowing the patient to hold it over the planned area of injection for 1 to 2 minutes is usually adequate. The same ice can be used immediately posttreatment to help reduce bruising and edema. Caution is advised to not overexpose the skin to the cold, because a burn might result.

### Topical Refrigerant Spray

Topical dichlorotetrafluoroethane and ethyl chloride skin refrigerant spray (Pain Ease; Gebauer Co, Cleveland, OH) can be applied to the treatment area 30 to 60 seconds before needle insertion for topical skin anesthesia (Figure 10). Such spray is perceived by the skin as very cold and

desensitizes topical nerves immediately upon application. Superficial skin pain response is significantly thwarted; however, the deeper dermal pain fibers still respond. The spray is not intended for use on oral mucosa and is offered only for use on the cheek and nasolabial folds. Caution should be exercised in use for those at risk for inflammatory or reactive hyperpigmentation.

### Local Nerve Blocks

Local nerve blocks<sup>49</sup> are frequently necessary periorally, especially for lip injections. Injectable anesthetic choices include lidocaine, with or without epinephrine, which are both painful upon injection. This can be blunted by placing a topical intraoral anesthetic, such as Denti-Care topical anesthetic gel, with 20%





**Figure 9.** Intraoral injection technique for midface correction with large-particle hyaluronic acid.



**Figure 10.** Topical anesthetic spray is used to desensitize the skin.

Benzocaine (Medicom, Lachine, Québec, Canada) to alleviate the discomfort associated with mucosal injections. However, the burning sensation is still noted as the anesthetic product is injected, likely because of the acidic nature of the agent.

Epinephrine in the anesthetic may help to reduce bruising; however, if epinephrine is included, the anesthetic effect may persist for 8 to 10 hours. This can be an uncomfortable experience for many patients because of the lack of oral sensation and can reduce oral competency. Septocaine articaine hydrochloride 4% with epinephrine (Septodont Inc, New Castle, DE) is favored by many dentists and is an excellent alternative to lidocaine. Even with its epinephrine content, its duration of effect is limited to 2 hours. Additionally, the Septocaine has a higher pH, thereby minimizing the burning sensation upon injection. Rarely, persistent paresthesias have been reported with Septocaine injections, specifically with mandibular injections. Caution is recommended to prevent direct injection of the neural foramen.<sup>50</sup>

### Local Nerve Block Techniques

A Septocaine ampule is placed into a stainless steel dental injector syringe with a 27-gauge, 1.25-in needle (Kendall Tyco Healthcare Group LP, Mansfield, MA). A cotton-tipped applicator with topical local anesthesia is placed on the buccal or gingival labial sulcus for 3 to 5 minutes (Denti-Care topical anesthetic gel). The needle is placed just above the canine at a 30° angle up to the canine fossa, with the bone of the anterior maxillary wall just lateral to the nasal-alar insertion. The needle is directed down to the bone and approximately 0.3 mL of anesthesia is injected. Distraction devices, such as a vibrating massager placed on the maxillary eminence, can significantly minimize injection discomfort (Figure 11). Injections are made bilaterally to achieve anesthesia to the entire upper lip within about 2 minutes. Alternatively, the injections can be accomplished transcutaneously (Figure 12). This technique is easier and more reliable when first learning nerve blocks, but it is also associated with a greater discomfort to the patient.

For lower lip anesthesia, following retraction of the lower lip, the second premolar is located and the needle

is inserted into the gingivolabial sulcus, about 0.5 in beneath and onto the bone of the mandible. Approximately 0.2 mL of anesthetic is injected bilaterally to anesthetize the entire lower lip and chin area (Figure 13). Because mandibular injections are slightly more painful than the maxillary injections, a distraction device placed on the mentum will significantly blunt pain perception (Figure 14).

Some physicians utilize a micro-nerve block technique, in which small aliquots of anesthetic are injected along the mucosal border of the lip near the gingival sulcus. Microblocks have the advantage of not producing as deep a regional anesthetic. However, this technique may take longer to perform and the potential for incomplete anesthesia is greater.

### INJECTION TECHNIQUES

To achieve successful filler treatments, there are a variety of different techniques used including threading, serial droplet, and fanning methods.

#### The Threading Method

Probably the most popular technique, threading is best used for treating the vermilion border. Threading is a technique which involves depositing the product as the needle is withdrawn from the tissue. In this technique, the needle is inserted to its hub, taking care that the needle is in the very deepest portion of the dermis or in the subdermal tissues. If the skin dimples down with downward pressure on the needle, then the needle is in the dermis. If the needle can be visualized through the skin, then it is too superficial and will generally not produce an aesthetically pleasing effect. If there is little resistance to the needle and the product upon injection, then the needle is in the subcutaneous tissue.

#### The Serial Droplet Method

This technique is commonly mentioned with silicone injection. It is described as placing the needle into the deep dermis (or deeper) and depositing a very minimal amount of product, approximately 0.01 to 0.03 mL. Multiple serial droplets are placed along the wrinkle, a



**Figure 11.** Intraoral injection with Septocaine is used to achieve anesthesia to upper lip. Vibrating distraction device is used to blunt discomfort with injection of anesthetic.



**Figure 13.** Inferior mental nerve block with injection of Septocaine near the mental foramen.



**Figure 12.** Transcutaneous injection of anesthetic down to anterior face of maxilla.



**Figure 14.** Vibrating distraction device on the mentum blunts the discomfort of injection.

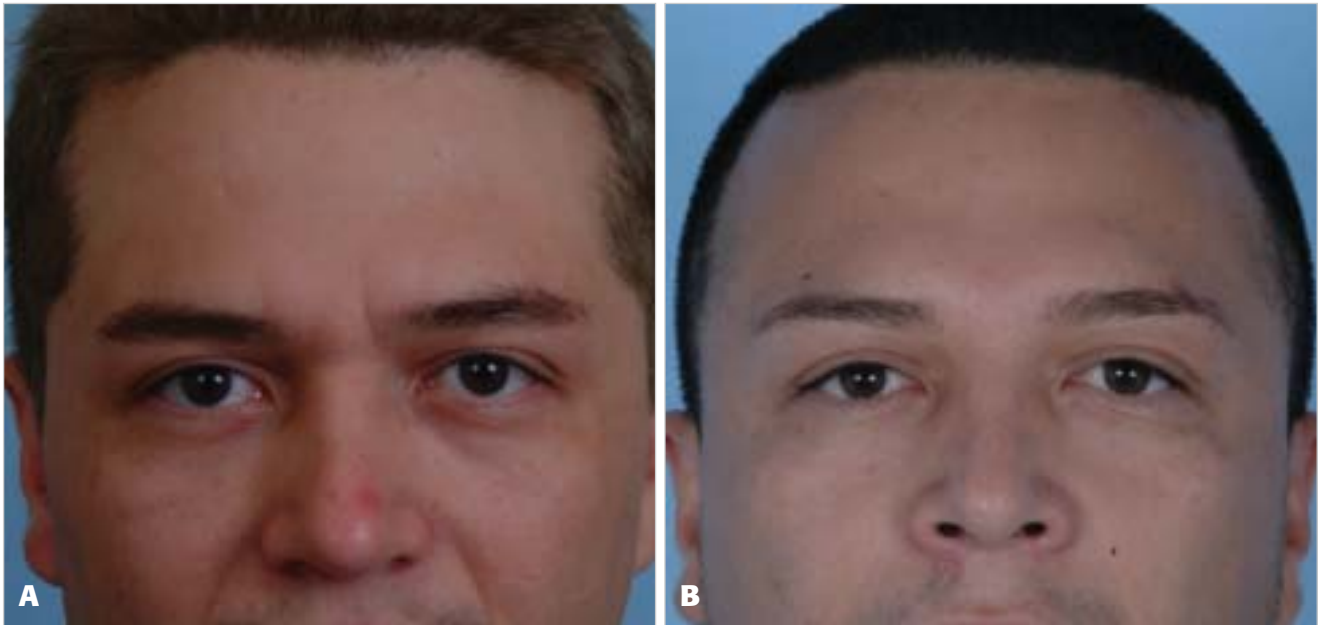
technique that can lead to beading and a dull needle, necessitating multiple needle replacements. This method is best utilized for treating the glabellar creases (Figure 15) and for placement along the inferior orbital rim in treating periorbital hollows.

### The Fanning Method

The fanning method is the preferred manner for achieving superior, natural appearing, and longer-lasting results. However, the amount of product that is used is dependent on the depth of the crease, the patient's desired outcome, and the patient's financial preferences. The fanning method is appropriate for placement of the product in the immediate subdermis or subcutaneous tissues. It is very difficult (if not impossible) to perform

the fanning technique in heavily resistant dermal tissues. Because the subdermal tissues are less resistant, allowing for more diffusion, more product is usually needed for complete correction with fanning as compared with other techniques.

In the fanning method, the needle is placed just below the dermis at a 30° angle with the bevel position irrelevant. The needle is passed back and forth under the fold, extending approximately 2 mm lateral to 2 mm medial to the fold (Figure 16). The product is deposited both as the needle is inserted and withdrawn, filling in an approximately 4-mm wide band of product with the fold in the center. The product should be deposited slowly and steadily. Injecting HA at 0.3 mL/min or slower has been determined to result in less ecchymoses.<sup>51</sup> In most patients, it will take at least 1 mL of filler per fold to achieve a satisfactory result. It is important to achieve complete correction but to stop at the desired cosmetically appealing endpoint and refrain from overcorrection. Results tend to improve over the next couple of weeks as inflammation subsides and as the product “settles” into the fold.



**Figure 15.** **A**, Pretreatment view of a 35-year-old man. **B**, Posttreatment view 1 year after placing hyaluronic acid via a serial droplet method into the glabellar creases.



**Figure 16.** Filler is placed in a lane extending 2 mm lateral and 2 mm medial to the nasolabial fold in a fanning method.

## DISCUSSION

Using appropriate patient selection, filler choices, and injection techniques, filler outcomes and patient satisfaction can be optimized. Two important ingredients of success are: (1) treating to complete correction and (2) appropriate placement of the filler material in the dermis.

In terms of complete correction, patient satisfaction following a filler treatment may be dependent on whether or not a complete aesthetic correction was achieved. Frequently, previously treated patients who are unsatisfied with their result were shown to have

been inadequately treated or undertreated. It is likely that if more product had been initially placed into the area of desired correction, the patient would have been more satisfied. Other than periorbitally (where undercorrection is the rule), when complete correction is attained the patient is more likely to be pleased, subsequently return, and refer other patients (Figure 17). Anecdotally, experienced injectors have recognized that if complete correction is initially accomplished, the correction persists longer. In all cosmetic procedures, the objective is to satisfy the patient. In fact, if the patient appears to be difficult to satisfy, it may be wise to discourage the treatment rather than produce an unhappy patient.

In terms of the appropriate placement of filler material in the dermis, in contrast to initial teachings and package inserts, it is the authors' experience that filler materials should not be placed in the dermis but, rather, deeper, for a more lasting and aesthetically natural result. Placement in the subdermis lifts the crease or fold, whereas product placed into the dermis can result in a "worm-like" blue line under the skin. This "tindle effect" is not only unsightly, but tell-tale evidence of a filler treatment. Fortunately, this misplaced product can be easily removed by nicking the skin with an 18-gauge needle and expressing the product (Figure 18). Filler can be removed in this fashion at any point following injection, from immediately after placement to months post-treatment. Occasionally, for large volume correction (i.e., cheeks and prejowl sulcus), the product is placed deeper into the subcutaneous tissues. At this level, the hydrophilic properties of the HA will diffusely expand in the area of desired correction. However, a significant volume of product may be necessary before the correction is appreciated.

As recently described, it is postulated that the stretch placed on the tissues by HA fillers stimulated dermal



**Figure 17.** **A**, Pretreatment view of a 68-year-old woman. **B**, Posttreatment view 12 months after complete correction with large-particle hyaluronic acid into the nasolabial folds.



**Figure 18.** **A**, Superficially placed hyaluronic acid leaves a prominent blue discoloration and fullness. **B**, An 18-gauge needle is used to nick the skin overlying the too superficially placed product. **C**, Misplaced hyaluronic acid is extracted 12 months after placement.

fibroblasts to produce collagen. While this study examined Restylane, this phenomenon may be relevant to all facial fillers.<sup>4</sup> Future studies focusing on correction longevity will likely elucidate variables contributing to optimal filler treatments.

## CONCLUSION

Current trends in facial rejuvenation have made a shift toward volume replacement complementing, or in lieu of, surgically advancing the skin and supporting ptotic tissues. Contemporary patients overwhelmingly request minimally invasive alternatives for achieving a rejuvenated appearance. Fillers can meet many of their desires, with concomitant high safety profiles and minimized downtime. With the rapidly evolving filler market, it is vital for physicians to make educated and thoughtful choices before broadly applying novel products. With today's commercially available materials, the aesthetic physician's armamentarium of facial fillers can be appropriately and effectively used to achieve significant cosmetic outcomes. Which products are ultimately used in a successful patient-filler scenario is dependent on the patient's aesthetic needs in combination with the physician's knowledge of current facial fillers and injection expertise. ▀

## DISCLOSURES

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