

Soft Tissue Augmentation With Dermal Fillers, Part 1: Lips and Lower Face

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As the development of new technologies and treatment approaches continue to expand the field of cosmetic surgery, dermal filler injections have become increasingly popular, minimally invasive means of improving aesthetic appearance. New filler materials have improved the ease of use with longer-lasting results as well as minimal adverse effects (AEs) and downtime. The aging lower face features characteristic changes that are particularly amenable to treatment with fillers. In this article, we discuss techniques used for successful lip augmentation as well as rejuvenation of the lower face through correction of the perioral rhytides, marionette lines, and prejowl sulci with frequently used dermal fillers. Although most dermal fillers are approved by the US Food and Drug Administration (FDA) for treatment of lines and wrinkles only, we encourage a more natural approach using global assessment of facial aging to develop an individualized approach to volume restoration and rejuvenation.

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The field of cosmetic surgery continues to expand with the development of new technologies and treatment approaches. Among the newest developments are injectable dermal fillers, which have become increasingly popular as a noninvasive means of improving aesthetic appearance, including the signs of aging. New filler materials are associated with improved ease of use, longer-lasting results, and minimal adverse effects (AEs) and downtime. The aging lower face undergoes characteristic

changes that are particularly amenable to treatment with dermal fillers. The effects of facial aging include bone resorption, loss of subcutaneous tissue, muscular atrophy, and decreased skin elasticity due to loss of collagen and elastic tissue. The process is unique in each individual and can lead to varying degrees of vertical perioral rhytides; downturned oral commissures; temporal atrophy; prominent prejowl sulci; and deep forehead lines, nasolabial folds, and marionette lines. Characteristically, aging lips also become thinner and flatter with blunting of the vermilion border, Cupid's bow, and philtral columns. The gradual changes associated with aging often cause the face to appear tired and unhappy, which can have social implications that affect how a person is perceived by others.¹ Soft tissue augmentation with surgical and minimally invasive procedures has dramatically evolved to help reverse the signs of aging in the lips and lower face. Although most dermal fillers are approved by the US Food and Drug Administration (FDA) for treatment of lines and wrinkles only, we encourage a more natural

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approach using global assessment to develop an individualized approach to volume restoration and rejuvenation.

In 1893, Neuber² became one of the first physicians to report the use of soft tissue augmentation by filling facial defects with fat removed from a patient's arms. Since then and especially over the last decade, the use of various dermal fillers has exponentially increased as a popular means of cosmetic enhancement and reversing the aging process. The first bovine collagen filler Zyderm (Allergan, Inc) was introduced in 1977³ and was approved by the FDA in 1981; however, this product was not ideal because of the short duration of its clinical efficacy and its immunogenic potential, which necessitated preinjection skin testing.^{4,5} A desire for a lower risk for hypersensitivity and longer-lasting effects led to the development of human collagen-derived fillers such as Autologen (Isolagen Technologies Inc), which was harvested from the patient's own skin but had a complex production process, and Dermalogen (Collagen Matrix Technologies, Inc), which was derived from tissue banks and introduced in 1998.^{4,6} However, longer-lasting products with a minimal risk for sensitivity were still desired. Introduced in 2003, the CosmoDerm and CosmoPlast (Inamed Corporation) family of fillers was developed based on the technology of growing a single cell line of human fibroblastic collagen in culture⁷; however, these products did not prove to have the long-lasting effects desired by both cosmetic surgeons and patients, and thus continued distribution has diminished with the advent of new filler materials.

More recently, the FDA's approval of tightly cross-linked, nonanimal-stabilized hyaluronic acid (HA) fillers for use in the United States has revolutionized soft tissue augmentation. Hyaluronic acid can be cross-linked to varying degrees, which determines the size and inherent nature of the product. Hyaluronic acid fillers, some containing lidocaine, primarily will be discussed in this article with regard to their use for augmentation in the lips and lower face. The HA fillers Restylane/Restylane L and Perlane/Perlane L (Medicis Aesthetics, Inc) as well as Juvéderm Ultra/Ultra Plus/Ultra XC/Ultra Plus XC (Allergan, Inc) are FDA approved for the correction of moderate to severe facial wrinkles and folds such as nasolabial folds, but there also has been reported success in other off-label indications. Recently, the FDA approved Restylane for lip augmentation in patients older than 21 years.

The effects of soft tissue augmentation procedures using these newer fillers tend to last for 6 to 12 months,⁸ though satisfactory results may persist for up to 18 months with re-treatment. In this article, we discuss the use of poly-L-lactic acid (PLLA)(Sculptra Aesthetic, sanofi-aventis US LLC) and calcium hydroxylapatite (CaHA)(Radiesse, Merz Aesthetics, Inc) in the lips and lower face. The

cosmetic indication for Sculptra Aesthetic includes correction of shallow to deep nasolabial fold contour deficiencies and other facial wrinkles. Radiesse currently is approved for use in the United States for moderate to severe facial wrinkles and folds such as nasolabial folds and for the correction of facial fat loss in patients with human immunodeficiency virus-associated lipoatrophy.⁹ For treatment of deeper lines or areas where structural support is needed, thicker filler materials can optimize outcomes, whereas thinner fillers are better suited for treatment of superficial rhytides and the superficial dermis.

CONSULTATION

Prior to any cosmetic procedure, the physician and the patient should comprehensively discuss potential AEs as well as other possible treatment options. It also is important to discuss the patient's desired outcome and to inform the patient of the likely degree of correction that is possible. Baseline photographs are essential in documenting and discussing any preexisting asymmetries, irregularities, or scars prior to injection.¹⁰ Informed consent should be obtained, and rare but potential AEs such as infection, formation of granulomas or nodules, the Tyndall effect, bruising, persistent numbness, intra-arterial injection, necrosis, pain, and hematoma formation should be noted. A detailed medical history including any facial nerve disorders, herpes simplex virus infection, hypertension, diabetes mellitus, pregnancy, and autoimmune disorders should be documented. If applicable, antiviral prophylaxis for herpes simplex virus should be prescribed. Once realistic expectations are addressed, an appropriate management plan can be initiated.

LIP AUGMENTATION

Noninvasive lip augmentation has become increasingly popular with the development of thinner HA fillers, which have become the most commonly used products in this area.¹¹ When considering augmentation with fillers, a comprehensive knowledge of the different anatomic components of the lips and the distinct structures that provide both the underlying support and youthful appearance of lips is imperative. Physicians must consider the following factors when assessing the lips: the shape and size of the upper and lower lips; the vermilion border; the white roll, a fine line of pallor skin that accentuates the circumferential vermilion skin border; the Cupid's bow; the philtrum, extending from the upper lip to inferior nasal septum; and the upper and lower labial tubercles.¹²⁻¹⁴ It is important to recognize signs of aging in the lips (Table) to provide optimal rejuvenation to the aspects that are most in need of correction and achieve an aesthetically pleasing result.¹⁰ The lips can be challenging to treat, as they are a focal point in social

Signs of Aging in the Lips

- Blunting of the Cupid's bow
- Blunting of the philtral columns and philtrum
- Downturned oral commissures
- Equal heights of the upper and lower lips
- Less distinction of the vermilion border
- Loss of pout
- Thinner flatter lips

interaction and emotional expression and are essential in drinking and eating.¹⁵ Even the slightest overcorrection can lead to an unsatisfied patient. Many reports have sought to document the ideal proportions of the lips, some using the golden ratio of 1 to 1.618 for the upper versus the lower lips as a guideline, whereas others have noted a more general ratio of one-third to two-thirds, respectively.¹⁶⁻¹⁸

Prior to injection, topical anesthetic agents can be applied, but in more sensitive patients, intraoral or transcutaneous nerve blocks can be administered to anesthetize the infraorbital and mental nerves for the upper and lower lips, respectively. To intraorally anesthetize the infraorbital nerve, lidocaine 1% is injected with a 30-gauge needle by introducing the needle into the mucosa above the gingiva between the upper first and second bicuspid (pre-molar teeth), aspirating to avoid intravascular injection, and injecting approximately 1.5 to 2 cc of anesthetic solution adjacent to the infraorbital foramen. A similar approach is utilized to intraorally anesthetize the mental nerve. An advantage of regional nerve blocks is that they provide adequate anesthetization without distorting the anatomy to be augmented.

Knowledge of the vascular anatomy of the area to be augmented is crucial to the success of the procedure. It is important to note that there may be variations or aberrations from the standard known vasculature in every patient. The superior labial artery supplies blood to the

upper lip and the inferior labial artery supplies the lower lip. Both are branches of the facial artery and bifurcate, coursing under the orbicularis oris muscle, to then anastomose with its companion artery from the other side. Individual vascular variations of both the superior and inferior labial arteries, which are well-documented in cadaveric studies, apply not only to branches of these vessels but also to their proximity to the cutaneous lip.¹⁹ Therefore, it is important to aspirate slightly prior to injection to ensure inadvertent arterial placement does not occur.

Among the available products, HA fillers are most often used for lip augmentation. Neither CaHA nor PLLA is suitable for lip rejuvenation and should not be injected at the vermilion border because of the higher risk for nodule formation in this area. The small gel particle HA filler Restylane has demonstrated results that last for at least 6 months (Figure 1).²⁰ Because of its intrinsic structural attributes that lack a granular consistency, Juvéderm is considered a smooth filler and is easily injected, making it another ideal product for lip augmentation (Figure 2).²¹ A 27- to 29-gauge needle usually is used to inject these HAs into the mid to lower dermis with avoidance of the superficial dermis to prevent the possible complication of the Tyndall effect (Rayleigh scattering), a bluish discoloration that can appear at the injection site. This effect can occur secondary to clear HA fillers being placed too superficially, causing refraction of blue light.

Although not FDA approved for this indication, a thicker HA filler such as Juvéderm Ultra Plus or large gel particle HA filler such as Perlane can be injected conservatively for lip augmentation for longer-lasting and more structurally robust results, with anecdotal reports of greater patient satisfaction. Because these products are thicker, the patient may feel or have a greater awareness of the filler's presence postprocedure, a potential effect that should be fully discussed with the patient prior to injection. These off-label uses should be closely monitored for any potential AEs such as nodule formation and usually require a smaller quantity of injected filler.

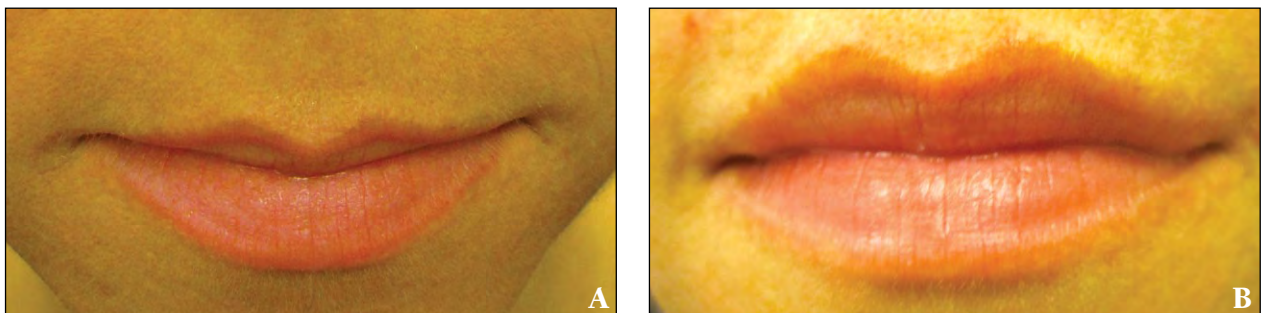


Figure 1. A 28-year-old patient before (A) and immediately after lip augmentation with hyaluronic acid (Restylane, Medicis Aesthetics, Inc)(B).

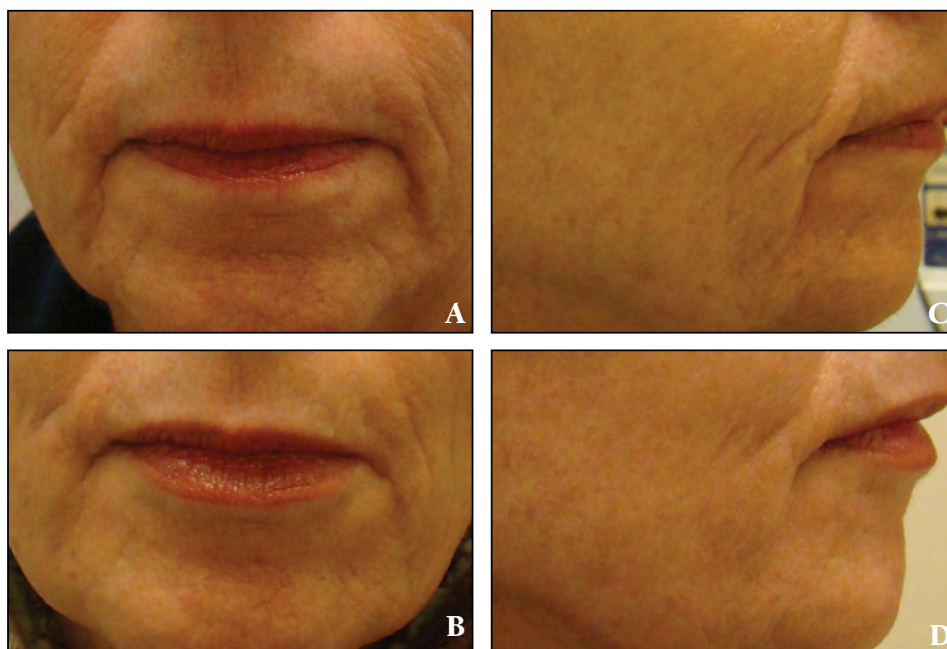


Figure 2. A patient before (front, A; profile, C) and immediately after lower face rejuvenation with calcium hydroxylapatite (Radiesse, Merz Aesthetics, Inc) and lip augmentation with hyaluronic acid (Juvéderm Ultra, Allergan, Inc) (front, B; profile, D).

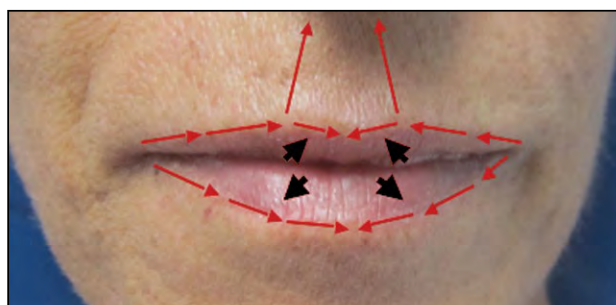


Figure 3. Preprocedure anatomical diagram of injection sites (black arrows) and technique in a patient desiring lip augmentation. Red arrows indicate direction of insertion; filling done in a retrograde fashion.

Although each patient should be treated uniquely, a systematic approach is useful. With the lip slightly stretched, the filler can be meticulously injected along the vermilion borders and the Cupid's bow utilizing a linear threading technique with slightly threaded depots placed at the tubercles of the lips to achieve the appropriate volume and eversion desired by the patient (Figure 3). Beginning with injections in the vermilion border and white roll is appropriate, as this practice can add volume and provide eversion without the need for further tubercle or labial body volume restoration. Different techniques have been purported for filler injection into the white roll. To recreate a defined white roll, one can inject into the space between the lip mucosa and orbicularis oris muscle. When the needle is correctly placed into this plane, the filler will flow in either an antegrade or retrograde fashion with only slight syringe plunger pressure. If a greater amount of pressure is needed or the filler creates a lump

instead of flowing freely, the needle has not entered the space as desired. In the central area of the upper lip, known as the Cupid's bow, the filler should be injected conservatively to recreate the V shape that lies inferior to the philtrum. The lateral limbs of the white roll/vermilion border can then be filled; however, it may not be necessary to fill the lateral limbs all the way to the lateral commissures. The lower white roll should then be filled similarly.

For further augmentation, injections can be made in the 2 sets of paired tubercles of the upper and lower mucosal lip in the mid to deep dermis. Adding this volume can recreate the natural pout of the mucosal lip. Finally, because the philtral columns often become blunted with age, a linear threading approach can be utilized to inject filler into these locations at the level of the mid dermis to achieve subtle protrusion of the upper lip with restoration of a youthful pout. Injection should occur along the patient's individual oblique angles because the patient's appearance could be distorted if the natural anatomical boundaries are not respected. The volume injected should reflect the degree of augmentation that the patient desires, accounting for the fact that immediate postoperative swelling can obscure the actual results. An appreciable goal is to retain the natural proportion of the upper and lower lips in a ratio of one-third to two-thirds, respectively.¹⁰ It is imperative to maintain an individualized approach to augmentation, as one approach for all is not recommended. In younger patients or patients who have retained a crisp vermilion border, sole augmentation of the tubercles or Cupid's bow may be all that is needed or desired. In a similar light, one may not want or need to fill the lateral portions of the vermilion borders because it may cause a noticeable upward

curvature. In older patients, augmentation of other areas of the lower face also should be considered.

PERIORAL RHYTIDES

Vertical perioral rhytides can develop in the upper cutaneous lip²² and tend to be more pronounced in patients who smoke. Because of the characteristics that make small particle or less viscous HA fillers beneficial for injection in the lips, they similarly can be periorally injected with ease in the mid dermis.²³ These HA fillers can be injected into finer lines, slightly perpendicular to the lines or even horizontally across the upper cutaneous lip; however, they do not provide the appropriate structural support needed to correct deeper lines where larger particle HA fillers would yield more desirable results. Caution should be taken to avoid overcorrection in this area to prevent overblunting in the upper cutaneous lip. Concurrent injection with a neurotoxin or concomitant use of fractional ablative or nonablative lasers also may optimize results, especially in patients with deeper lines.^{24,25} It is important to note that PLLA is a poor candidate for treatment of perioral rhytides given the higher risk for subcutaneous papules and nodules.

MARIONETTE LINES AND DOWNTURNED ORAL COMMISSURES

With age, the depressor anguli oris and the platysma muscles pull the corners of the mouth downward; because of decreased elasticity of the surrounding skin, the marionette lines become more prominent and this downturning of the lips becomes more obvious.¹⁵ All HA fillers as well as CaHA can be used to successfully treat superficial marionette lines, but this application also is considered off label.⁹ For correction of these lines, filler can be placed under the folds using a linear retrograde and/or fanning approach, or, when appropriate, filler can be placed deep and perpendicular to the lines in a cross-lined pattern to stretch the skin and provide structural support to the triangle created by the marionette lines, prejowl sulcus, and commissures. For deeper, more prominent marionette lines, CaHA or a larger particle HA filler can be injected in the deep dermis or subdermal plane to provide structural support, and an HA filler can be layered above this plane for finer correction. A recent study recommended higher volumes of HA filler for the marionette lines, similar to the volume used for the nasolabial folds, for optimal results.¹⁵

For deeper depressions creating downturned oral commissures, a serial puncture approach may yield better results. If the desired result is not achieved using this technique, additional structural support may be required in the surrounding area, which can be achieved by injecting into the most lateral portion of the upper lip to elevate

the angle of the mouth or, in more severe cases, injecting more superior and lateral to these areas.¹⁴

JOWLS/JAWLINE

In the natural course of aging, bone resorption is one of the dominant characteristics that induces the appearance of facial recession.²¹ Correction of the jowls/jawline with soft tissue augmentation is off label but can help to redefine the loss that has occurred due to aging. The jawline and the prejowl sulcus require sound structural support at the level of the deep dermis or subdermal plane. Radiesse and Perlane both provide excellent structural support and can be injected using various techniques, including serial puncture, fanning, and linear threading. Smaller quantities of Radiesse may be required to achieve the same level of correction as HA fillers.⁹ Radiesse and Perlane should be injected in a deeper plane to lay down a matrix of support because of the loss of underlying bone and soft tissue. An important aspect of prejowl sulcus correction with filler is to recreate the inferior border of the mandible instead of just injecting volume over the body of the mandible.⁹ Using CaHA to fill this area will promote the growth of collagen in this area, and thus help create structural support for the overlying areas. Thinner HA fillers can be precisely injected over these areas for the correction of finer lines. A combination approach with the utilization of both CaHA and HA in certain areas with greater bone absorption with overlying deep rhytides may help achieve the most optimum and long-lasting results.

If volume is needed in the lower jaw area and prejowl sulcus, PLLA may be beneficial in appropriate patients and has begun to be used more frequently.^{8,21,26} A fanning technique can be used to inject PLLA at the inferior aspect of the ramus with a series of injections administered at least 4 weeks apart.

ADVERSE EVENTS

In addition to the previously mentioned AEs, side effects associated with HA injections (eg, bruising, tenderness, edema, pain) have been linked to rapid injection speed, higher volumes of injected filler, and use of the fanning technique.^{27,28} Injector experience and knowledge of facial anatomy play an important role in minimizing undesired outcomes.²³ Intra-arterial injection can be avoided by pulling back on the syringe plunger before injecting to ensure that the needle has not entered an artery. Areas at higher risk for inadvertent arterial injection include the angular artery when filling the melolabial and nasolabial folds as well as the superior and inferior labial arteries when augmenting the upper and lower lips, respectively. Although proper knowledge of vascular

anatomy can help to avoid intra-arterial injection, it is important to have protocol in place in case it occurs, such as application of warm compresses, nitroglycerin paste, or hyaluronidase when injecting HA fillers.

CONCLUSION

Products, techniques, and combination modalities for soft tissue augmentation have evolved dramatically over the years, and ease of use, patient comfort, and duration of results continue to improve. Each filler has its own utility; some fillers provide more structural support, others are more effective for correcting finer lines and wrinkles, and others provide volume. When used as directed by the FDA, fillers have proven to be efficacious; however, off-label applications for lip augmentation may provide longer duration of clinical results and improved patient satisfaction in the appropriate setting. Regular follow-up every 3 to 4 months after filler injections allows for less volume with subsequent treatments as well as a well-maintained, aesthetically pleasing appearance. The future of soft tissue augmentation remains to be seen but will prove to be exciting and rewarding.

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