CONTINUING MEDICAL EDUCATION

Injection technique in neurotoxins and fillers: Planning and basic technique

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Cosmetic dermatologic surgery has evolved to be a minimally invasive field that addresses patient concerns with a multimodal approach while minimizing adverse events and downtime. Within the armamentarium of dermatologic surgery, injections of soft tissue augmentation materials and neuromodulators are key tools for recontouring the aging face. Treatment of the individual patient is preceded by a comprehensive consultation that elicits patient concerns and preferences. A treatment plan is collaboratively developed to correct relevant deficits and retreat as appropriate to maintain the correction. The goal of volumization with fillers is to recreate atrophic subcutis and dermis, thereby filling the deflated face and returning it to a more youthful contour. Neurotoxins can help minimize the emergence of static wrinkles and selectively recontour the face. Treatment techniques for both filler and neurotoxin injections are customized for particular patient needs and are based on the type of deficit and the anatomic location. (J Am Acad Dermatol 2018;79:407-19.)

Key words: Bellafill; Belotero; Botox; consultation; Dysport; filler; hyaluronic; injection; Juvederm; neuromodulator; neurotoxin; Radiesse; Restylane; Sculptra; technique; Xeomin.

Cosmetic medicine has been revolutionized by the emergence and acceptance of prepackaged injectable fillers and neuromodulators. Facial rejuvenation was once only available to those who could afford major plastic/reconstructive surgery, but these modalities have now made this process safer, more affordable, and immediate. Dermatology has been at the forefront, the specialty most associated with leading innovation in fillers and neuromodulators as judged by both primary care physicians and the general public.1,2

The purpose of this review is to describe how patients are treated with fillers and neuromodulators. We focus on technique alone because a broader review is beyond the scope of a succinct narrative.3 We begin by characterizing the cosmetic consultation, treatment selection, and the way treatments are tailored to individual patients.3 The current thinking

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regarding the process of facial aging is summarized. Finally, the specific maneuvers required for injection of fillers and neuromodulators, respectively, are delineated. The second article in this continuing medical education series discusses the specific injectable products available, particular indications, avoiding and managing adverse events, developing a treatment plan, and combining injectables with other procedures.

THE CONSULTATION: WHERE AND WHEN TO INJECT FILLER AND TOXIN

Key points
- Elicit and address patient concerns and preferences in a preinjection consultation
- Smaller volume injections at fewer anatomic sites may allay anxieties in novice patients
- Less patient education is required with neuromodulators, which are associated with briefer downtime and less contour change
- Neuromodulator injections for the upper face are commenced when etched lines begin to emerge

The filler injection process begins with the consultation. Patients who previously received filler and were pleased are easiest. A review of documentation regarding previous treatments helps ensure a comparable outcome in the future. Treatment intervals may be extended as small quantities of filler may persist. The potential utility of novel agents that have been approved by the US Food and Drug Administration since the patient’s last visit may be discussed. Patients previously treated by others may be asked what was injected, where, in what amount, and how frequently. Patients may also be asked how they felt about the final look, 2 to 3 weeks after injection, when edema and erythema had subsided. Some injectors believe that patients who have received injectable silicone or other permanent fillers are not good candidates for temporary fillers, which may elicit an idiosyncratic immune reaction. Newcomers to filler injections will typically be more anxious. They are asked what most bothers them about their appearance, and if multiple areas are highlighted, which are most upsetting. The injector can also gently insert their own preferences, noting that they are trying to provide a professional appraisal likely more indicative of the opinion of friends and family. Patients are often alarmed by the immediate change in their facial contour from the first injections and are reassured posttreatment. Patients’ overall satisfaction with fillers derives from comparison of the benefits, including youthful appearance, reduced wrinkles, and convenience, versus the costs, including time, expense, downtime, and injection discomfort. The tolerance of first-time injectees is unknown, and it behooves the injector to begin by injecting modest amounts in one or two areas. In days to weeks, when swelling diminishes, other areas can be injected, and undertreated areas can be touched up.

As with filler, before neuromodulator injections, it is useful to review the patient’s history to understand previous treatments. Patients may not remember the method used by other injectors but can communicate the posttreatment features that they found attractive or problematic. This information is used to deduce injection appropriate placement going forward. A history of brow ptosis, preference for brow elevation, or other considerations can guide treatment pattern. Downtime after botulinum injections is negligible as the tiny erythematous macules at injection sites resolve spontaneously, are concealed with makeup, or can be gently massaged away. Patients may be uncertain when they should begin undergoing neuromodulator treatments. It has been suggested that the time to start injecting the upper face is when dynamic creases generated by muscle movement begin transitioning to static creases, or etched lines present even at rest. In patients with fine, fair skin, like redheads, this can occur in the early twenties, while darker patients with ethnic skin may see such a change several decades later.

MANAGING PATIENT EXPECTATIONS AND DEVELOPING AN ONGOING PLAN

Key points
- Swelling, redness, and occasional bruising can occur after injections, particularly with fillers
- A predetermined treatment schedule helps maintain the desired cosmetic correction

Patients tend to be satisfied with filler injections if their expectations are coincident with outcomes. Before treatment, patient expectations may be colored by a flawed understanding of the procedure. Common misapprehensions are that injections inevitably cause an unnatural, overfilled appearance, or that fillers are risky. Conversely, patients may have unrealistically rosy beliefs about how little filler is required and how long it may last. Incorrect patient expectations should be explicitly corrected clearly and respectfully. Appropriate counseling keeps patients from unexpectedly having to cancel significant social or work events. Sticker shock, which may be associated with the realization that multiple vials may be required several times a year, can similarly be avoided with clear communication. Satisfied patients tend to return for repeat treatment.
Monitoring retention rates can help an injector assess their own performance in aligning expectations with outcomes. Overall, filler and neuromodulator treatments have been associated with improved psychosocial function and even relief from depression.5-7

Quantities injected and the frequency of injections are based on patient-specific factors. To maintain a stable contour, injections of temporary fillers are required at least once annually, and commonly twice or more often. Quantities can be adjusted, with repeat injections often requiring less material. Age-related volume loss causes a gradual increase in the correction amount over the long term.

Toxin injections are resisted by a subset of patients who are worried about being injected with a “poison.” Posttreatment concerns are rare with toxin injections, which are not generally associated with swelling, bruising, or other tissue effects. Patient satisfaction with toxin injections is among the highest for a minor cosmetic procedure. Patients are generally not concerned about inconvenience or imprecision. Some patients need to be reassured that there is no physical addiction, and failure to maintain their injection schedule will not result in accelerated signs of aging.

PLANNING: THE IMPACT OF CHRONOLOGICAL AND PHOTOAGING ON INDICATIONS FOR TREATMENT

Key points
• Injections help make the patient appear as young as he or she feels while maintaining the natural facial structure
• Filler injections correct atrophied or descended facial fat pads that shape the face
• Volumization is an alternative or complement to skin reduction procedures like facelifts
• Injection-based rejuvenation procedures need to be tailored to the patient's ethnicity

Early analyses of beauty led to now outdated notions that the ideal face met fixed criteria.8-19 So-called “golden ratios” were used to define optimal dimensions of the upper and lower face and to specify localization of the nose and spacing between the eyes. More recently, it has been accepted that beauty comes in different forms and sizes. Modern cosmetic interventions aim not to transform patients into idealized figures but rather to help them become fresher, more youthful versions of themselves. The goal is to make patients look more like they feel, given that these two representations may diverge over time. Research suggests that posttreatment patients look several years younger to others, but fillers are not a time machine. Erasure of aging is not possible, and likely not even desirable.

Historically, the prevailing wisdom was that photoaging and chronological aging produced excess skin and subcutis that could be rectified by skin reduction, like a facelift. With the advent of fillers, the aged facial soft tissue envelope was reconceptualized as analogous to a “deflated beachball” (Fig 1). Deflation, it was posited, could be contoured by adding filler to replace lost fat. The current opinion is that nonspecific, diffuse reinflation of atrophied areas is not sufficient to improve aged skin, with anatomically appropriate reshaping of facial subunits best able produce an attractive, age-appropriate contour. Fillers are often part of a combination approach including other minimally invasive and invasive techniques.

The youthful face has been represented as an equilateral triangle (Fig 2, A) pointing downwards. Age-related sagging produces an inverted triangle. Cadaver studies have identified fat pads underneath the superficial facial subcutis. Interlocking laterally and supporting the dermis vertically, these pads are subject to gravitational descent with time (Fig 2, B). Infracocular slippage results in the exacerbation of tear trough depressions and nasojugal folds, and subsequent downward and medial rotation accentuates nasolabial folds.

Racial variation impacts skin aging and its correction.14,20-39 Compared to the aged face in white patients, the aged African American face (Fig 3, A) typically exhibits more midface and eyelid laxity, with pseudoherniation of the orbital fat pads and prominent nasolabial folds. On the neck, blunting of the cervicomental angle is generally more notable than the fine wrinkles in older whites. The African American face tends toward malar hypoplasia and proptosis, and therefore injection into the midface or attempts to camouflage proptosis may be
inappropriate. In Latina patients (Fig 3, B), aging causes a thicker, fuller midface, with excess skin and sagging of the upper and lower eyelids; nasolabial folds may become prominent, but the chin is often recessed. It is important to understand the ethnic starting point of patients to address their aged face. Photographs from youth may show the baseline facial architecture, which may be even more complex in patients with mixed ethnicities.

Racial variation implies different sizes and orientations of facial features. The mouth is less wide and the mandible is wider in Asian (Fig 3, C) versus white faces. Asian and African noses have a wider base but a less tall tip than noses of white patients. Typical Asian faces have an intercanthal distance greater than those of white patients.

The degree of aging impacts the placement of neuromodulators. Those older than their fifties or with severe photodamage have a weaker frontalis muscle that is treated sparingly to avoid brow ptosis or a “heavy” feeling. Danger zones, like close above the mid-brow or below the eyelid, are injected carefully. Lax lower eyelids exhibit a positive “snap test,” precluding midline injections to avoid scleral show. The snap test is a maneuver to test the elasticity of the lower eyelid skin and muscle. The skin at the center of the lower eyelid is pinched and pulled away from the globe and then released. If the skin spontaneously retracts quickly, the snap test is negative and neurotoxin injections in the mid-lower eyelid will likely be well-tolerated; if retraction occurs slowly, this positive snap test indicates that elasticity is diminished, and localized neurotoxin may result in ectropion. Incipient static creases in a young patient may indicate premature skin aging, and toxin may forestall their imminent deepening. Photographs of older family members may reveal the likely course of aging.

**TIME ALLOCATION FOR FILLER AND TOXIN INJECTION**

**Key point**
- **Filler injections are time-intensive because contour and symmetry must be preserved**

Relevant work before the delivery of botulinum toxin for mitigation of facial creases includes preinjection preparation, such as selection of toxin, reconstitution and dilution, and mapping of the face. Injection itself is simple and quick. However, the injection of temporary prepackaged injectable soft tissue augmentation materials is more time-consuming, with delivery of even a single vial requiring effort comparable to the planning and execution of an elliptical excision. Overinjection must be avoided, and right to left symmetry must be maintained.

**BASIC INJECTION TECHNIQUES: FILLERS**

**Key points**
- Most injectable fillers are placed in the subcutis, with more viscous, thicker fillers placed deeper
- Common injection techniques include serial puncture, linear threading, cross-hatching, fanning, and depot placement
Fillers are layered to correct areas where fine superficial lines overlie deeper volume loss.

Filler injection remains more art than science, elevating aesthetic improvement above the erasure of specific lines and depressions.

Most common fillers (Table I) in the United States are “linear fillers,” space-occupying substances injected into the skin to immediately and directly modify contour. No matter their chemical composition, linear fillers can be compared based on rheology, a fluid mechanics term describing their viscosity (ie, resistance, flow, or thickness) and elasticity (ie, stickiness or structure). Some fillers are thicker and require more hand force to eject from the syringe through the needle, with this greater cohesiveness and firmness impacting both how they feel and how likely they are to cause tissue trauma, including swelling and bruising. Thicker, more viscous fillers are injected deeper into the subcutis and offer greater structural support, and often greater in vivo persistence.

There is no consensus on the appropriate method for cleansing the skin before filler injection or even whether such preparation is routinely required. Alcohol and chlorhexidine may be used more often than betadine, which can stain clothes and skin. Some practitioners are satisfied if patients simply remove any make-up and wash the treatment area with soap and water. Facial skin, the most common site of filler injection, is generally well-perfused and resistant to infection. Off the face, when hands are injected with filler—a preparation solution is commonly used.

The depth of injection of linear fillers (Fig 4) is a source of frequent confusion given the ubiquity of the term “dermal fillers,” particularly in the plastic surgery literature. In fact, virtually all linear fillers are injected into the subcutis, usually the high subcutis below the dermis. Deeper injections can be wasteful, suborbital fat accumulates, and nasolabial folds grow.

Compared to whites, the young (left) African American face has relative malar hypoplasia. As the typical African American face ages (older face on right, younger on left), fat redistribution and descent, including in the submental area, is more notable than the fine lines, wrinkles, and skin laxity more often seen in aging whites. B, Typical Latino faces, young and old. Younger faces (left) tend to be wider and fuller, with thicker subcutaneous fat pads. Like Asians, Latinos have a wider intercanthal distance than whites, with lateral canthi that are higher than medial canthi. Chins can be small and recessed, and noses slightly wide but not overall large in size. As Latinos age (right), thick folds but few fine wrinkles appear as the copious soft tissue sags. Eyelids and eyebrows become heavy and descend.

Fig 3. A, Typical African American faces, young and old. Compared to whites, the young (left) African American face has relative malar hypoplasia. As the typical African American face ages (older face on right, younger on left), fat redistribution and descent, including in the submental area, is more notable than the fine lines, wrinkles, and skin laxity more often seen in aging whites. B, Typical Latino faces, young and old. Younger faces (left) tend to be wider and fuller, with thicker subcutaneous fat pads. Like Asians, Latinos have a wider intercanthal distance than whites, with lateral canthi that are higher than medial canthi. Chins can be small and recessed, and noses slightly wide but not overall large in size. As Latinos age (right), thick folds but few fine wrinkles appear as the copious soft tissue sags. Eyelids and eyebrows become heavy and descend.

C, Typical Asian faces, young and old. Asians (left) tend to have the widest intercanthal distances and the most slant in the eyes, with lateral canthi markedly higher than medial canthi. Mouths are less wide and mandibles are more prominent and wider in Asians compared to whites. Like Latinos, Asians have broader noses that are less protruberant at maximal elevation. Similar to Latinos and African Americans, Asians age (right) with fewer fine lines, wrinkles, and skin laxity than whites. Sagging fat pads may also be less notable in aging Asians than those of other ethnicities.
Table I. Common fillers used in the United States and their properties

<table>
<thead>
<tr>
<th>Trade name *</th>
<th>Company</th>
<th>Primary material</th>
<th>Concentration</th>
<th>Anesthetic</th>
<th>Anesthetic</th>
<th>FDA-approved indication</th>
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<tr>
<td>Bellafill</td>
<td>Suneva Medical, Inc</td>
<td>PMMA beads, collagen, and lidocaine</td>
<td>20% PMMA microspheres 3.5% bovine collagen</td>
<td>0.3% lidocaine</td>
<td>d d d d</td>
<td>Correction of NLFs and moderate to severe, atrophic, distensible facial acne scars on the cheek in patients &gt;21 years of age</td>
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<tr>
<td>Belotero Balance</td>
<td>Merz Pharmaceutical</td>
<td>HA</td>
<td>22.5 mg/mL</td>
<td>None</td>
<td>128 and 35</td>
<td>BDDE cross-linked</td>
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<tr>
<td>Juvederm Ultra</td>
<td>Allergan</td>
<td>HA</td>
<td>24 mg/mL</td>
<td>None</td>
<td>94 and 35</td>
<td>Hylacross highly cross-linked</td>
</tr>
<tr>
<td>Juvederm Ultra Plus</td>
<td>Allergan</td>
<td>HA</td>
<td>24 mg/mL</td>
<td>None</td>
<td>135 and 38</td>
<td>Hylacross highly cross-linked</td>
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<tr>
<td>Juvederm Ultra Plus XC</td>
<td>Allergan</td>
<td>HA</td>
<td>24 mg/mL</td>
<td>0.3% lidocaine</td>
<td>244 and 263</td>
<td>Hylacross highly cross-linked</td>
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<tr>
<td>Juvederm Ultra XC</td>
<td>Allergan</td>
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<td>0.3% lidocaine</td>
<td>207</td>
<td>Hylacross highly cross-linked</td>
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<td>Product</td>
<td>Manufacturer</td>
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<td>Concentration</td>
<td>Lidocaine</td>
<td>Cross-Linked</td>
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<td>HA</td>
<td>15 mg/mL</td>
<td>0.3% lidocaine</td>
<td>Vycross tightly cross-linked</td>
<td>Injection into the lips for lip augmentation and for correction of perioral rhytids patients &gt; 21 years of age</td>
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<td>Juvederm Vollure XC</td>
<td>Allergan</td>
<td>HA</td>
<td>17.5 mg/mL</td>
<td>0.3% lidocaine</td>
<td>Vycross tightly cross-linked</td>
<td>Correction of moderate-to-severe facial wrinkles and folds (such as NLFs) in patients &gt; 21 years of age</td>
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<tr>
<td>Juvederm Voluma XC</td>
<td>Allergan</td>
<td>HA</td>
<td>20 mg/mL</td>
<td>0.3% lidocaine</td>
<td>Vycross tightly cross-linked</td>
<td>Deep (subcutaneous and/or supraperiosteal) injection for cheek augmentation to correct age-related volume deficit in the midface in patients &gt; 21 years of age</td>
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<tr>
<td>Radiesse</td>
<td>Merz Pharmaceutical</td>
<td>Calcium hydroxylapatite</td>
<td>None</td>
<td>None</td>
<td>BDDE cross-linked</td>
<td>Correction of moderate-to-severe facial wrinkles and folds (such as NLFs) and also for restoration or correction of the signs of facial fat loss (lipoatrophy) in patients with HIV</td>
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<td>Restylane Defyne</td>
<td>Galderma Laboratories, L.P.</td>
<td>HA</td>
<td>20 mg/mL</td>
<td>None</td>
<td>BDDE cross-linked</td>
<td>Correction of moderate-to-severe facial wrinkles and folds, such as NLFs, and for submucosal implantation for lip augmentation in patients &gt; 21 years of age</td>
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<th>Concentration</th>
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<th>Rheology</th>
<th>Cohesivity (gmf)</th>
<th>Crosslinking</th>
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<td>G' (Pa) = elasticity</td>
<td>5 Hz</td>
<td>0.7 Hz</td>
<td>G'' (Pa) = viscosity</td>
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<td>Galderma Laboratories, L.P.</td>
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<td>20 mg/mL</td>
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<td>HA</td>
<td>20 mg/mL</td>
<td>0.3%</td>
<td>lidocaine</td>
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<td>Restylane-L</td>
<td>Galderma Laboratories, L.P.</td>
<td>HA</td>
<td>20 mg/mL</td>
<td>0.3%</td>
<td>lidocaine</td>
<td>710&lt;sup&gt;42&lt;/sup&gt; and 864&lt;sup&gt;40&lt;/sup&gt;</td>
<td>677&lt;sup&gt;43&lt;/sup&gt;</td>
<td>204&lt;sup&gt;42&lt;/sup&gt; and 185&lt;sup&gt;62&lt;/sup&gt;</td>
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<td>Sculptra</td>
<td>Galderma Laboratories, L.P.</td>
<td>PLLA</td>
<td>367.5 mg in vial</td>
<td>None</td>
<td>—</td>
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bdde, 1,4-butanediol diglycidyl ether; HA, hyaluronic acid; gmf, grams-force; NLF, nasolabial fold; PLLA, poly-L-lactic acid; PMMA, polymethylmethacrylate.

*Trade names are property of their respective owners.
other hand, retrograde injections may be preferred or cannula, tissue trauma may be minimized. On the extruded filler precedes the sharper tip of the needle vessel lumina; in addition, because a stream of soft creating an artifactual tunnel that transects planes or where it is required, without the needle or cannula cleave tissue planes naturally and deposit filler injection include that the pressure of injection can course of filler delivery. Benefits of anterograde injections provide the security of preplanning the can facilitate needle insertion, while retrograde injections allow hydrodissection of the tissue, which withdrawn from the most distant point). Anterograde injection causes intense back pressure and slow flow. When this occurs, the needle tip should be reposi-
tioned into the subcutis. All rules have exceptions, with some thin linear fillers (eg, Belotero [Merz Pharma GmbH, Frankfurt, Germany] and the no longer available human and bovine collagens) appropriate for intradermal injection. Experienced injectors may deliver minute quantities (eg, 0.01-mL aliquots) of less viscous fillers into the dermis to correct irregularities like fine ice pick acne scars, but this is not a routine or recommended approach.

Common injection methods include “linear threading” and “serial puncture.” In linear threading (Fig 5, A), the needle is inserted at an acute angle (<90°) and then advanced laterally. Injection can be anterograde (commenced at the point of insertion and continued while the needle is advanced) or retrograde (initiated as the needle is withdrawn from the most distant point). Anterograde injections allow hydrodissection of the tissue, which can facilitate needle insertion, while retrograde injections provide the security of preplanning the course of filler delivery. Benefits of anterograde injection include that the pressure of injection can cleave tissue planes naturally and deposit filler where it is required, without the needle or cannula creating an artificial tunnel that transects planes or vessel lumina; in addition, because a stream of soft extruded filler precedes the sharper tip of the needle or cannula, tissue trauma may be minimized. On the other hand, retrograde injections may be preferred because they offer more control over filler placement, with this being placed precisely and exclusively into a preexisting tunnel created by the operator, moreover, because the tunnel for injection already exists, less injection pressure may be needed to expel the filler from the syringe. Whichever method is chosen, injection should be avoided while the needle is traversing the dermis to avoid leaving small, visible intradermal nodules.

Serial puncture (Fig 5, B) is a subtly different technique comprised of numerous small injections. Each injection perforates the dermis followed by extrusion of a droplet of filler into the high subcutis. The needle is then withdrawn, repositioned a small distance away, and the process is repeated. Unlike linear threading, serial puncture does not rely on much lateral movement of the needle within the subcutis.

The benefits of serial puncture include (1) less risk of needle trauma because the needle enters and exits without horizontal displacement that could nick vessels; (2) precise delivery to each locus; and (3) suitability for small defects. The benefits of linear threading include (1) fewer skin entry points per unit area; (2) even, uniform delivery of filler; and (3) a diminished risk of intradermal injection given fewer insertions.

The angle of insertion during filler placement is a matter of physician preference. In general, serial puncture may predispose to a perpendicular approach and linear threading a narrower angle of incidence, which lends itself to lateral advancement. Alternatively, vertical insertion may be followed by lateral redirection to enable linear threading. Such an approach reduces intradermal travel, minimizing the likelihood of transection of dermal vessels. Conversely, vertical injections can induce excessively deep placement because the needle tip is poorly visualized.

Injection methods frequently used for large areas and deep soft tissue defects like atrophied cheeks include “cross-hatching” and “depot injections” (Fig 5, C). Cross-hatching can literally entail the placement of a row of linear threads, followed by another row at right angles. To minimize trauma, injectors may select a fanning pattern, whereby an arc of linear threads emanate from a single injection point. After each thread, the needle is retracted, redirected a few degrees, and pushed forward again. Fans can be propagated from several entry points to create a cross-hatching pattern.

Depot injections solve the same problem in an altogether different way. Rather than dispersing a wafer of filler in the superficial subcutis, depots
create a nodule of filler deep at the center of the defect. Manual compression is used to spread this evenly. Requiring one injection per site, depots may help reduce insertion-associated pain, bruising, and palpable dermal nodules. Spreading of the depot can, however, induce pain and bruising. Multiple smaller depot injections may therefore be preferred. Intraoral depot injections may further minimize cutaneous trauma, but such injections may be less precise and prone to bacterial colonization. Biofilms resistant to antibiotics can be created as the oral flora enter the subcutis.

Dilution of fillers with lidocaine has been used to control pain and adjust filler thickness. Hyaluronic acid derivative fillers (eg, Restylane, Juvederm) and injectable calcium hydroxylapatite (Radiesse) are approved by the US Food and Drug Administration for delivery in combination with lidocaine and supplied in premixed syringes. Off-label modifications include further dilution with additional lidocaine, using female-to-female syringe adaptors. When fillers are diluted, care is taken to ensure that the resulting mixture is of uniform consistency. Finer solutions may be useful for superficial defects and reduce bruising. Filler function is not impeded by addition of lidocaine. Very dilute mixtures will be largely lidocaine, which will be resorbed, suggesting the need for a subsequent touch-up procedure.

**Fig 5.** A. Linear threading. The needle is inserted at a shallow angle almost parallel to the skin, and as the needle is advanced and/or withdrawn, a long, continuous stream of injectant is delivered. Multiple threads may be placed in a given area. Benefits include the need for fewer entry punctures, and risks, less precision in placement. B. Serial puncture. The needle is reinserted and removed, and small aliquots delivered, at numerous points along a wrinkle or other area to be treated. Benefits include precision of placement. Risks, because of the need to repeatedly ascertain the correct depth of injection, include the possibility of inadvertent injection into the intradermal plane. C. Cross-hatching and depot. In cross-hatching (patient’s right), linear threads are placed in a criss-cross manner, perpendicular to each other, to intensely and uniformly fill a tissue plane in a broad target area. Cross-hatching permits the injection of larger volumes into larger areas while maintaining a smooth, even contour. Depot injections are a single large bolus of injectant, and are often placed deep, just above the bony margin at the level of the periosteum. Depots can dramatically fill one specific area, or they can be massaged to spread less noticeably fill a broader, wider area.
Different fillers can correct a multipart defect. For instance, a fine line may overlie a deep crease at the nasolabial fold. Thicker filler material may be injected into the mid-subcutis to elevate the deep crease, and thinner filler may be pushed under the dermis to efface the fine rhytids. Layering can be accomplished with different filler materials or different dilutions of the same.

Similarly, treatment of different indications may require different techniques. For instance, acne scars may be corrected with serial puncture delivery of small aliquots into the reticular dermis or superficial subcutis. Nasolabial folds may be directly corrected using a variety of methods, including serial puncture, linear threading, or cross-hatching of the entire area in layers, with different fillers. Upper cheek and lower face augmentation may require cross-hatching, fanning, or even deep depot injections to sculpt the facial contour. Infraorbital correction of tear troughs or nasojugal folds may be best accomplished with linear threading through a cannula, thereby minimizing the number of entry sites and therefore of inadvertent cutaneous trauma that may manifest as ecchymoses.

The facial skin is a 3-dimensional structure of parallel planes connected by soft tissue ties. This complex layer cake deforms in unexpected ways. For instance, a marionette line at the oral commissure may be unresponsive to filler, and further injection may deepen it. Therefore, in areas of thin tissue or at hypermobile regions, it is prudent to inject small quantities at intervals of several weeks or months. In this manner, the soft tissue scaffold at the site is gradually strengthened. Spaces between assimilated filler provide room for additional injectable material. Injection technique has shifted from a focus on filling specific depressions to a preference for more diffuse volumization that reshapes the face. Experienced injectors use fillers to treat entire “zones,” augmenting the mid- and upper cheeks, inflating temple hollowing, and blending perioral rhytids. Augmenting the upper face restores the youthful facial contour while providing lift that softens nasolabial creases. Zone injecting has its limits. No amount of upper face filler can entirely obscure perioral, perinasal, and periorbital lines, which do require some degree of direct correction.

While basic filler techniques are easily explained, the placement of filler remains more art than science. Frequent practice coupled with a sense of proportion allows skillful injectors to create natural, age-appropriate contours. While sufficiency of filler is important, more is not always better. Overinflation may camouflage aging at the cost of creating a cartoon-like appearance. Very deep injections of copious quantities of linear fillers can diffuse in unpredictable ways, sometimes resulting in successful elevation of a region, and sometimes in decreased efficacy and volume enhancement at undesired locations. Fashion impacts soft tissue augmentation, with the recent emphasis on exaggerated upper cheek volumization giving way to the popularity of thick lips in young women. However, most patients prefer a natural appearance that conceals the visible signs of aging without adding the telltale signs of a trip to the dermatologist.

**BASIC INJECTION TECHNIQUES: TOXINS**

**Key points**

- Neuromodulator injections are used to minimize upper face lines, including vertical glabella rhytids, horizontal forehead lines, and crow’s feet
- Commonly treated muscles include the frontalis, the procerus, the corrugators, and the orbicularis oculi
- Short, small-bore needles minimize injection trauma
- More concentrated neurotoxin solutions have their effect closer to the point of injection (ie, have a narrower action halo), and more dilute solutions impact skin further away (ie, have a wider action halo) but with a relatively lesser degree of effect

The technique for the use of botulinum toxin for facial rhytids owes its invention and refinement to the work of two pioneers, Jean and Alastair Carruthers. Initial dermatologic uses for botulinum toxin included the reduction of upper face rhytids, notably those of the glabella, forehead, and crow’s feet.

Injections are typically placed symmetrically in the upper face, commonly into the frontalis, procerus, corrugators, and orbicularis oculi. Short, small-bore needles are inserted at acute to perpendicular angles. Superficial dermal injections bruise less often because fewer vessels are traversed. Deeper injections at the periosteum may elicit a disconcerting audible popping sound, but they also minimize the visible intradermal papules at the sites of injection. The longer persistence of deeper injections remains unproven.

The smallest effective dose is used to avoid unwanted outcomes like asymmetry, brow or lid ptosis, ectropion, or mouth or lip asymmetry. Electrophysiologic guidance is not used to place botulinum toxin into facial muscles. Distance from external anatomic landmarks may be used instead since anatomic variation is modest. Common
configurations for injections can be expressed in stylized diagrams.

Reconstitution volume, dilution, and distance of effect from the point of injection are related concepts. Botulinum toxin type A, whether ona-, abo-, or inco-, is provided dehydrated from the manufacturer, and must be mixed with sterile normal saline before injection. Per 100-unit vial of ona- and inco-, and per 300-unit vials of abo-, the quantity of saline used for reconstitution varies widely, from 1 to 10 mL. Concentrated solutions result in a smaller action halo around the point of injection.

Variation in technique

As discussed above, injection treatments are designed to address individual patient features while being age-, ethnicity- and sex-appropriate. The methods described are not exhaustive but are rather a set of basic tools.

REFERENCES


