

Treatment Areas



Frown Lines



FIGURE 1 ● Frown lines before (**A**) and 1 month after (**B**) botulinum toxin treatment of the glabellar complex, with active frowning. Copyright R. Small, MD.

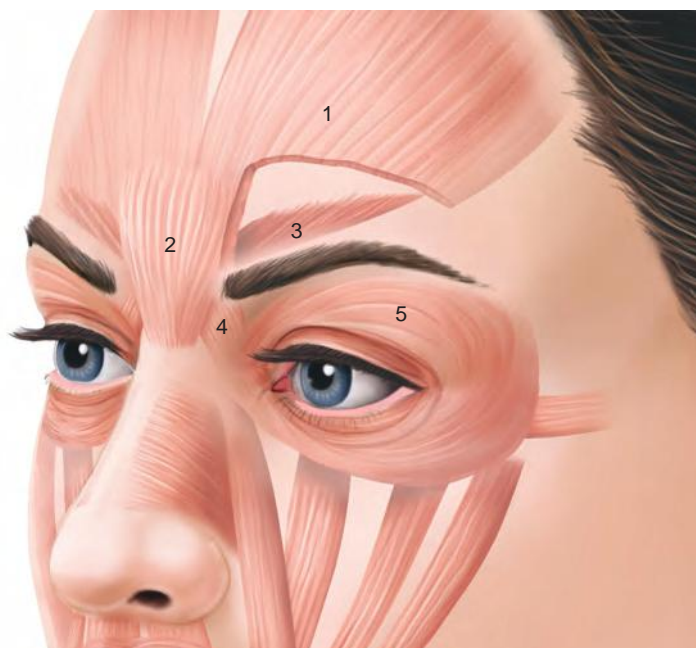
Dynamic frown lines result from contraction of glabellar complex muscles. These lines convey irritation, frustration, or anger and reduction of frown lines is one of the most common cosmetic complaints. Botulinum toxin treatment of the glabellar complex reduces frown lines by inhibiting contraction of these muscles and smoothing the overlying skin.

Indications

- Frown lines
- Medial eyebrow elevation

Anatomy

- **Wrinkles.** Frown lines, or glabellar rhytids, are vertical lines between the medial eyebrows (see Anatomy section, Figs. 4 and 5).
- **Muscles targeted.** Botulinum toxin frown line treatment targets the glabellar complex depressor muscles, which include the corrugator supercilii, procerus, and depressor supercilii (see Anatomy section, Figs. 1 and 2). The corrugator



- | | |
|-----------------------------|----------------------------|
| 1. Frontalis m. | 4. Depressor supercilii m. |
| 2. Procerus m. | 5. Orbicularis oculi m. |
| 3. Corrugator supercilii m. | |

FIGURE 2 ● Glabellar complex detailed anatomy. Copyright R. Small, MD.

and depressor supercilii muscles lie beneath the frontalis and procerus muscles (Fig. 2).

- **Muscle functions.** Contraction of the glabellar complex muscles draws the eyebrows medially and inferiorly (see Anatomy section; Fig. 7 and Table 1).
- **Muscles avoided.** The portion of the frontalis muscle which is lateral to the corrugator muscles is avoided with treatment of the glabellar complex.

Patient Assessment

- **Dynamic** (with muscle contraction) and **static** (at rest) **frown lines** are assessed.
- **Concomitant frontalis and glabellar complex muscle contraction** with frowning (Fig. 3) are assessed. Patients who use both these muscle groups when frowning may require treatment of the frontalis in addition to treatment of the glabellar complex muscles to smooth frown lines.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform any of the following expressions:

- “Frown like you’re mad”
- “Concentrate”



FIGURE 3 ● Frontalis and glabellar complex muscle contraction with frowning. Copyright R. Small, MD.

Treatment Goals

- Complete inhibition of glabellar complex muscles.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts, Reconstitution Method section).
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women: 20 units of OBTX
- Men: 25 units of OBTX

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 1-inch needle

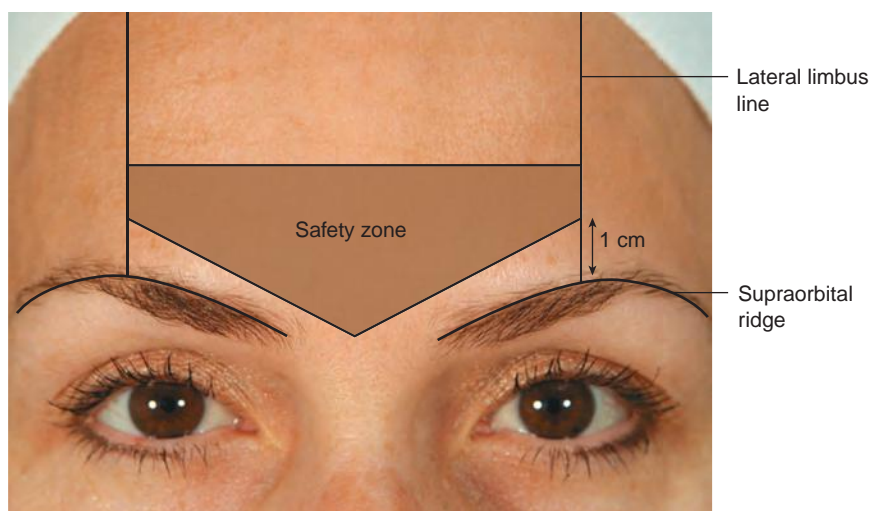


FIGURE 4 ● Frown line safety zone for botulinum toxin treatments. Copyright R. Small, MD.

Procedure Overview

- Place injections within the frown line safety zone (Fig. 4). The safety zone is at least 1 cm above the supraorbital ridge at the lateral limbus line, and extends inferiorly to a point approximately 1 cm below the glabellar prominence. It is bounded by vertical lines extending from the lateral limbi to the hairline.
- An overview of injection points and OBTX doses for treatment of frown lines is shown in Figure 5.
- Botulinum toxin is injected intramuscularly for treatment of frown lines.
- Injecting inferior to the safety zone, less than 1 cm above the supraorbital ridge at the lateral limbus line, increases the risk of blepharoptosis (droopy upper eyelid).

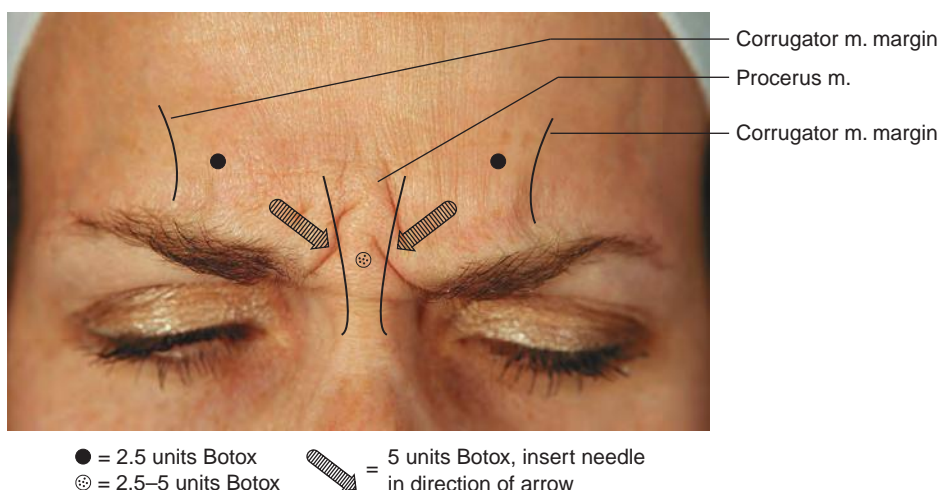


FIGURE 5 ● Overview of botulinum toxin injection points and doses for treatment of frown lines. Copyright R. Small, MD.

- Injecting lateral to the safety zone may involve the frontalis muscle, resulting in eyebrow ptosis (droopy eyebrow).

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the frown line safety zone (Fig. 4).
3. Locate the glabellar complex muscles and identify the lateral margins of the corrugators that lie within the safety zone by instructing the patient to contract the muscles, using one of the facial expressions above.
4. Identify the injection points (Fig. 5).
5. Ice for anesthesia (optional).
6. Prepare injection sites with alcohol and allow to dry.
7. The provider is positioned on the same side that is to be injected.
8. While the glabellar complex muscles are contracted, insert the needle 1–2 cm above the supraorbital ridge at the lateral margin of the corrugator muscle within the safety zone. Angle the needle towards the procerus muscle and insert to half the needle length (Fig. 6). Inject 2.5 units of OBTX with gentle, even plunger pressure as the needle is slowly withdrawn.



FIGURE 6 ● Lateral corrugator muscle botulinum toxin injection technique. Copyright R. Small, MD.



FIGURE 7 ● Medial corrugator muscle botulinum toxin injection technique. Copyright R. Small, MD.

9. The second injection point is placed deep in the body of the corrugator muscle, approximately 1 cm medial and inferior to the first injection point, closer to the eyebrow (Fig. 7). Angle the needle towards the procerus muscle and insert to the hub. Inject 5 units of OBTX as the needle is slowly withdrawn.
10. Repeat the above injections for the contralateral side of the face.
11. The third injection point is in the procerus muscle. Reposition to stand in front of the patient. While the glabellar complex muscles are contracted, approach inferiorly, direct the needle towards the glabella, insert to half the needle length, and inject 2.5–5 units of OBTX (Fig. 8).
12. Compress the injection sites firmly, directing pressure away from the eye.

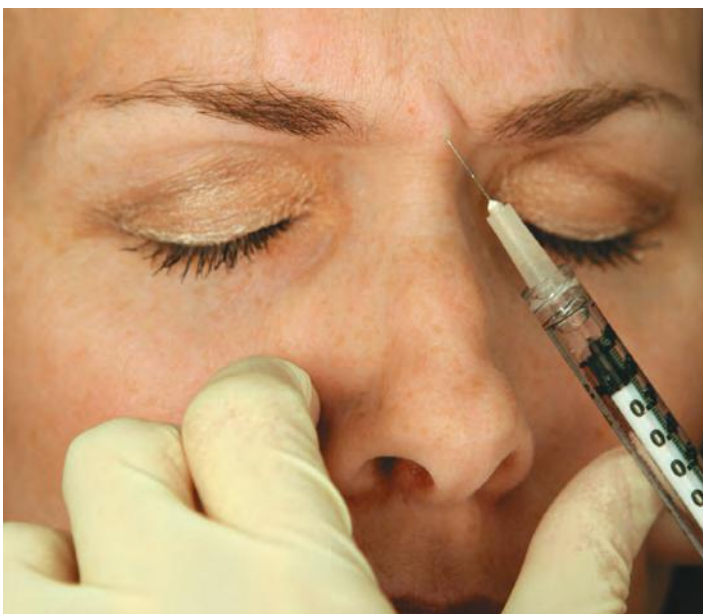


FIGURE 8 ● Procerus muscle botulinum toxin injection technique. Copyright R. Small, MD.

Results

- Reduction of dynamic frown lines is typically seen 3 days after botulinum toxin treatment, with maximal reduction at 1–2 weeks (Figs. 1A and 1B).

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns 3–4 months after botulinum toxin treatment.
- Subsequent frown line treatments with botulinum toxin may be performed when the glabellar complex muscles begin to contract, prior to lines returning to their pretreatment appearance.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of frown lines. If persistent frown lines are present, evaluate for the following common causes:

- **Glabellar muscle contraction.** Patients may have greater muscle mass than anticipated in the treatment area and additional botulinum toxin may be required to achieve desired results. Persistent muscle contraction can be corrected with a touch-up procedure using 5–10 units of OBTX, depending on the degree of glabellar muscle activity present.
- **Broad glabellar complex musculature.** If the lateral margins of the corrugators extend outside the safety zone lines these portions of the corrugators will not receive treatment. These untreated portions of the corrugators retain function and may cause medial frown lines. Treating these active lateral portions of the corrugators is not advisable because of the risks of blepharoptosis and eyebrow ptosis.
- **Frontalis muscle contraction with frowning.** In some patients, frontalis muscle contraction contributes to frown line formation and botulinum toxin treatment of the frontalis may be required to achieve optimal frown line reduction.
- **Static lines.** Patients with superficial static lines that do not have an underlying depression may require several consecutive botulinum toxin treatments for results to be seen. Patients with deep static lines that have an underlying depression often benefit from combining botulinum toxin with dermal fillers (see Combining Aesthetic Treatments below).

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts, Complications)
- Blepharoptosis (droopy eyelid)
- Eyebrow ptosis (droopy eyebrow)

Blepharoptosis is a temporary complication that can occur with botulinum toxin treatment of the glabellar complex muscles, particularly if toxin is injected too close to the supraorbital ridge at the lateral limbus line. Figure 9 shows a patient 3 weeks after botulinum toxin treatment (not by the author) to glabellar complex muscles with a profound right-sided blepharoptosis and mild right eyebrow ptosis. Blepharoptosis is typically seen as a 2–3-mm lowering of the affected eyelid, which is most marked at the end of the day with muscle fatigue. It is infrequent (1–5%), almost always unilateral, and usually resolves spontaneously within 6 weeks.



FIGURE 9 ● Right blepharoptosis. Copyright R. Small, MD.

Blepharoptosis results from migration of botulinum toxin through the orbital septum fascia to the levator palpebrae superioris muscle in the upper eyelid. Some of the levator palpebrae superioris muscle fibers pass up through the orbital septum to attach on the supraorbital ridge at the lateral limbus, and botulinum toxin can migrate into the levator palpebrae superioris at this point.

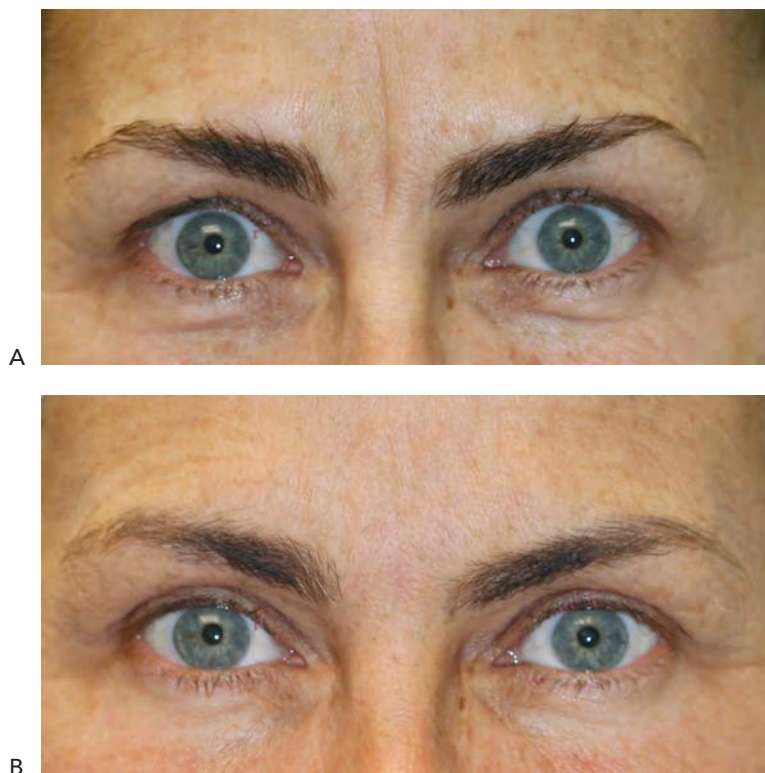


FIGURE 10 ● Deep static frown line before (A) and 1 month after (B) combination treatment with botulinum toxin in the glabellar complex and dermal filler in the frown line. Copyright R. Small, MD.

Blepharoptosis can be treated using over-the-counter alpha-adrenergic eye drops, such as naphazoline/pheniramine (e.g., Naphcon-A, one drop four times per day in the affected eye) or with prescription apraclonidine 0.5% solution (e.g., Iopidine, one to two drops three times per day). Both of these medications cause contraction of Mueller's muscle, an adrenergic levator muscle of the upper eyelid, resulting in elevation of the upper eyelid. Iopidine is reserved for refractory cases and should be used with caution as it can exacerbate or unmask underlying glaucoma.

- **Eyebrow ptosis** can result from relaxation of the lateral frontalis muscle, if botulinum toxin is injected lateral to the lateral limbus lines.

Combining Aesthetic Treatments and Maximizing Results

- **Deep static frown lines** associated with an underlying depression usually respond to a combination of botulinum toxin and dermal filler treatments. Figure 10 shows a deep static frown line before (Fig. 10A) and 1 month after (Fig. 10B) combination treatment with botulinum toxin in the glabellar complex and dermal filler treatment of the volume deficit.

Pricing

Charges for botulinum toxin treatment of frown lines range from \$200–\$500 per treatment or \$10–\$25 per unit of OBTX.

Horizontal Forehead Lines



FIGURE 1 ● Horizontal forehead lines before (A) and 1 month after (B) botulinum toxin treatment of the frontalis muscle, with eyebrow elevation. Copyright R. Small, MD.

Dynamic horizontal forehead lines result from contraction of the frontalis muscle. Botulinum toxin treatment of the frontalis reduces forehead lines by inhibiting muscle contraction and smoothing the overlying skin. Frontalis muscle contraction also affects eyebrow shape and height, and certain botulinum toxin injection techniques in this area can result in lateral eyebrow elevation.

Indications

- Horizontal forehead lines
- Lateral eyebrow elevation

Anatomy

- **Wrinkles.** Horizontal forehead lines, or frontalis rhytids, course across the forehead (see Anatomy section, Figs. 4 and 5).
- **Eyebrow position and shape.** In women, high arched eyebrows are usually desired. In men, a flat eyebrow shape is usually preferable (see Eyebrow Lift chapter, Figs. 2A and 2B).
- **Muscles targeted.** Botulinum toxin horizontal forehead line treatment targets the broad frontalis muscle, which spans the forehead attaching laterally at the temporal fusion lines (see Anatomy section, Figs. 1 and 2).



FIGURE 2 ● Dermatochalasis of the upper eyelid is a contraindication to horizontal forehead line treatment. Copyright R. Small, MD.

- **Muscle functions.** Frontalis muscle fibers are oriented vertically and contraction of this levator muscle raises the eyebrows. The inferior 2-cm portion has the most significant effect on eyebrow height and shape (see Anatomy section, Fig. 7 and Table 1).

Patient Assessment

- **Dynamic** (with muscle contraction) and **static** (at rest) **horizontal forehead lines** are assessed.
- **Dynamic and static eyebrow shape** is assessed.
- **Eyebrow ptosis** (low-set, droopy eyebrows) and **upper eyelid dermatochalasis** (skin laxity or redundancy) are assessed with the frontalis muscle at rest. Figure 2 shows a patient with significant upper eyelid dermatochalasis. Patients with these conditions often have horizontal forehead lines as frontalis muscle contraction is compensatory to elevate low set eyebrows and reduce upper eyelid skin laxity. While treatment with botulinum toxin will improve forehead lines, it can worsen these other conditions and, when getting started with botulinum toxin injections, it is advisable to avoid treatment in patients with dermatochalasis and eyebrow ptosis. As experience is gained with injection placement and dosing in this area, providers may choose to treat patients with these more challenging presentations.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform any of the following expressions:

- “Raise your eyebrows up like you’re surprised”
- “Lift up your forehead”

Treatment Goals

- Complete inhibition of the medial frontalis muscle to reduce horizontal forehead lines with partial inhibition of the lateral frontalis muscle in order to maintain a desirable eyebrow shape.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts section, Reconstitution Method)
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women: 15–22.5 units of OBTX
- Men: 20–25 units of OBTX

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

Procedure Overview

- Place injections within the horizontal forehead line safety zone (Fig. 3). The safety zone is bounded by vertical lines at the lateral limbi and includes the area 2 cm above the supraorbital ridge to the hairline, as well as a small area lateral to the vertical lines approximately 2 cm inferior to the hairline. Confining treatment to the safety zone minimizes the risk of eyebrow ptosis and preserves eyebrow shape and height.

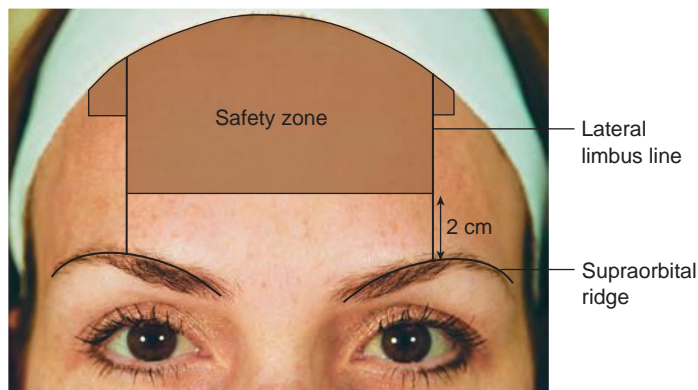
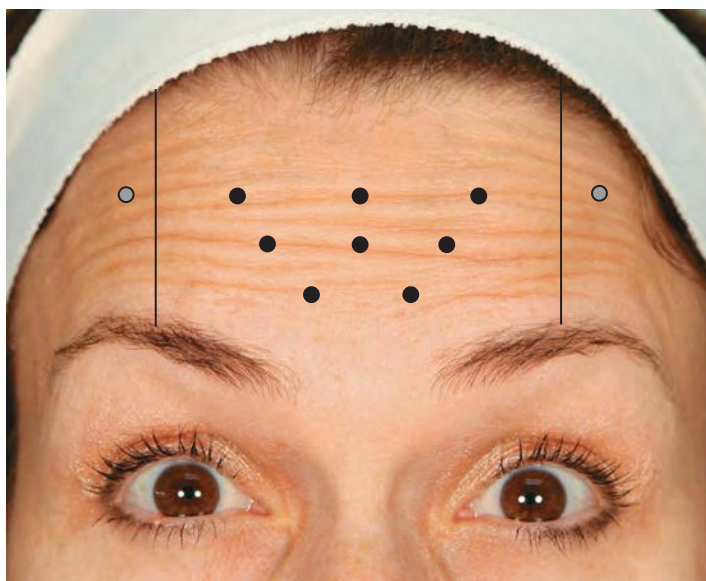


FIGURE 3 ● Horizontal forehead line safety zone for botulinum toxin treatments. Copyright R. Small, MD.



● = 1.25–2.5 units Botox ● = 2.5 units Botox

FIGURE 4 ● Overview of botulinum toxin injection points and doses for treatment of horizontal forehead lines. Copyright R. Small, MD.

- An overview of injection points and OBTX doses for treatment of horizontal forehead lines is shown in Figure 4.
- Botulinum toxin is injected intramuscularly for treatment of horizontal forehead lines.
- Botulinum toxin placement and dosing lateral to the limbus lines can be tricky. Injecting inferior to the safety zone in this region or using high doses increases the risk of lateral eyebrow ptosis. However, botulinum toxin placed too superiorly near the hairline or use of very small doses may result in a peaked eyebrow shape. In general, it is better to have a result with peaked eyebrows (which can be corrected) than eyebrow ptosis.
- The “v-shaped” injection pattern shown in Figure 4 minimizes botulinum toxin injection in the lateral portion of the frontalis muscle and helps to preserve the eyebrow arch by elevating the lateral eyebrow, which is desirable for women. A flatter eyebrow shape can be achieved by injecting botulinum toxin a bit more inferiorly in the lateral frontalis.
- Injecting inferior to the safety zone between the limbus lines increases the risk of medial eyebrow ptosis.
- Avoid injecting too deeply and thus hitting the periosteum, which is painful and dulls the needle.

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the horizontal forehead safety zone (Fig. 3).

3. Locate the frontalis muscle and identify the ridges of the frontalis muscle by instructing the patient to contract the muscles, using one of the facial expressions above.
4. Identify the injection points (Fig. 4).
5. Ice for anesthesia (optional).
6. Prepare injection sites with alcohol and allow to dry.
7. The provider is positioned in front of the patient.
8. While the frontalis muscle is contracted, insert the needle into the frontalis muscle within the safety zone lines. The needle is angled at 30-degrees to the forehead and the tip is inserted into the muscle ridge. Inject 2.5 units of OBTX with gentle, even plunger pressure (Fig. 5).



FIGURE 5 ● Medial frontalis muscle botulinum toxin injection technique. Copyright R. Small, MD.

9. Continue laterally along each ridge of frontalis muscle within the safety zone lines, injecting 2.5 units of OBTX approximately 1 cm apart. Perform injections evenly across the forehead to achieve symmetry (Fig. 6).
10. The final injection is placed just lateral to the safety zone line approximately 2 cm below the hairline, at the maximal point of eyebrow elevation. Inject 1.25–2.5 units of OBTX and repeat for the contralateral side.
11. Compress the injection sites firmly, directing pressure lateral to the safety zone line away from the eye.



FIGURE 6 ● Frontalis muscle botulinum toxin injection technique. Copyright R. Small, MD.

Results

- **Reduction of dynamic horizontal forehead lines and lateral eyebrow elevation** are typically seen 3 days after botulinum toxin treatment with maximal improvement at 1–2 weeks (Figs. 1A and 1B).

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns 3–4 months after treatment.
- Subsequent horizontal forehead line treatments with botulinum toxin may be performed when the frontalis muscle begins to contract before the lines return to their pretreatment appearance.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of forehead lines and eyebrow symmetry and eyebrow shape at rest and with active eyebrow elevation.

- **Peaked Eyebrow Shape or “Quizzical Brow”.** Peaked eyebrows are most noticeable with animation and are due to excessive contraction of the lateral frontalis muscle. This can occur in patients with strong lateral frontalis muscles, if lateral frontalis muscle injections have been omitted, or if small botulinum toxin doses have been injected too superiorly in the lateral frontalis. Peaked eyebrows can be corrected with 1.25–2.5 units of OBTX placed just inferior to the lateral safety zone, in line with the most peaked portion of the eyebrow. Figure 7 shows a patient actively contracting the frontalis muscle demonstrating mildly peaked eyebrows bilaterally 2 weeks after treatment with 22.5 units of OBTX in the frontalis muscle and injection points for correction. Figure 1B shows the same patient 2 weeks after receiving 1.25 units of OBTX above each peaked eyebrow (4 weeks after the initial treatment) and represents the final result.



● = 1.25–2.5 units Botox

FIGURE 7 ● Peaked eyebrows and correction with botulinum toxin.
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Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts section, Complications)
- Eyebrow ptosis (droopy eyebrow)
- Eyebrow asymmetry
- Blepharoptosis (droopy upper eyelid)

Eyebrow ptosis is one of the most significant complications from botulinum toxin treatment of the frontalis muscle. Excessive botulinum toxin dosing in the frontalis muscle or placement inferior to the safety zone can result in eyebrow ptosis. Patients often present with a complaint of heaviness of the upper eyelid on the affected side. Eyebrow ptosis may be unilateral or bilateral and is typically seen as a lowering and flattening of the affected eyebrow, while the palpebral fissures are unaffected and symmetric (unlike with blepharoptosis, where the palpebral fissure on the affected side is reduced). The medial, lateral, or entire eyebrow may be affected, depending on the region of frontalis muscle that is involved. Figure 8 shows a patient before (Fig. 8A)



FIGURE 8 ● Eyebrow position before (A) and 2 weeks after (B) botulinum toxin treatment of the frontalis muscle demonstrating eyebrow ptosis. Copyright R. Small, MD.



○ = 1.25 units Botox ● = 2.5 units Botox ◐ = 1.25–2.5 units Botox

FIGURE 9 ● Eyebrow asymmetry and correction with botulinum toxin. Copyright R. Small, MD.

and 2 weeks after (Fig. 8B) botulinum toxin treatment with 20 units of OBTX in the frontalis muscle demonstrating medial eyebrow ptosis. Eyebrow ptosis resolves spontaneously as botulinum toxin effects wear off. Medial eyebrow ptosis may be improved by treating the glabellar complex with botulinum toxin if this area is untreated (see Frown Lines chapter). Lateral eyebrow ptosis may be improved by treating the superior lateral orbicularis oculi with botulinum toxin and lifting the lateral eyebrow (see Eyebrow Lift chapter).

Eyebrow asymmetry may result from eyebrow ptosis and/or a peaked eyebrow. Figure 9 shows eyebrow asymmetry 2 weeks after botulinum toxin treatment with 22.5 units of OBTX in the frontalis muscle. The patient has a lower, flattened right eyebrow and a peaked left eyebrow. This asymmetry may be corrected by treating the superior lateral orbicularis oculi on the right side with botulinum toxin to lift the lateral eyebrow (see Eyebrow lift chapter), and treating the lateral frontalis on the left side to reduce the peaked eyebrow.

Blepharoptosis is uncommon with frontalis muscle treatments. It can result from inferior placement of botulinum toxin at the lateral limbus line with diffusion into the levator muscles of the upper eyelid. See Frown Lines chapter, Complications, for additional information on blepharoptosis and management strategies.

Combining Aesthetic Treatments and Maximizing Results

- **Eyebrow position and height** can be optimized by balancing depressor and levator muscle effects on the eyebrows with botulinum toxin treatments. Botulinum toxin treatment of the eyebrow depressor muscles, such as the glabellar complex (see Frown lines chapter) and superior lateral orbicularis oculi muscles (see Eyebrow lift chapter), complement botulinum toxin treatment of the frontalis levator muscle and reduce the risk of eyebrow ptosis.

- **Deep static horizontal forehead line** results can be enhanced by combining botulinum toxin treatments with resurfacing procedures such as fractional ablative lasers or chemical peels.

Pricing

Charges for botulinum toxin treatment of horizontal forehead lines range from \$200–\$500 per treatment or \$10–\$25 per unit of OBTX.

Crow's Feet



FIGURE 1 ● Crow's feet before (A) and 1 month after (B) lateral orbicularis oculi muscle botulinum toxin treatment, with active muscle contraction. Copyright R. Small, MD.

Dynamic crow's feet result from contraction of the orbicularis oculi muscle. Treatment of the lateral orbicularis oculi muscle with botulinum toxin inhibits contraction, reducing crow's feet and elevating the lateral eyebrow.

Indications

- Crow's feet
- Lateral eyebrow lift

Anatomy

- **Wrinkles.** Crow's feet, or lateral canthal rhytids, radiate laterally from the eye (see Anatomy section, Figs. 4 and 5).
- **Muscles targeted.** Botulinum toxin crow's feet treatment targets the lateral portion of the orbital orbicularis oculi muscle. The orbicularis oculi muscle is a superficial, thin, sphincteric muscle, which encircles the eye (see Anatomy section, Figs. 1 and 2). It has a palpebral portion covering the eye and an orbital portion around the eye (see Lower Eyelid Wrinkles chapter, Fig. 3).

- **Muscle functions.** Different regions of the orbicularis oculi muscle have different functions (see Anatomy section, Fig. 7 and Table 1). The lateral orbital portion of the orbicularis oculi muscle functions as a lateral eyebrow depressor (see Eyebrow Lift chapter) and contributes to formation of crow's feet. The palpebral portion of the orbicularis oculi muscle functions to close the eyelid both voluntarily and as part of the blink reflex. Lacrimal function, with lacrimal flow from the superior lateral gland to the medial lacrimal sac, is dependent on overall orbicularis oculi muscle strength.
- **Muscles avoided.** The lip levator muscles lie deep to the orbicularis oculi muscle and are avoided with treatment of crow's feet. The upper lip levators include the zygomaticus major and minor which are located near the lateral portion of the orbicularis oculi muscle at the superior margin of the zygomatic arch (see Anatomy section; and the levator labii superioris, levator labii superioris alaeque nasi, and levator anguli oris muscles which are located medially (see Anatomy section, Figs. 1, 2, and 3).

Patient Assessment

- **Blepharoplasty** and other facial surgery history is reviewed. Surgically altered anatomy may increase the risk of complications such as lip ptosis from lip levator muscle involvement. Ophthalmologic history, including keratorefractive (LASIK) surgery, is obtained as this may increase the risk of dry eyes.
- **Dynamic** (with muscle contraction) and **static** (at rest) crow's feet are assessed.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform any of the following expressions:

- "Make a cheesy grin" or "make a big smile"
- "Squint like the sun is in your eyes"
- "Wink"

Treatment Goals

- Complete inhibition of the lateral orbicularis oculi muscle.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts section, Reconstitution Method).
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women: total (bilateral) dose is 15–20 units of OBTX
- Men: total (bilateral) dose is 20–25 units of OBTX

Anesthesia

- Anesthesia with ice is not recommended as it vasoconstricts and can obscure blood vessels.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30- or 32-gauge, 0.5-inch needle

Procedure Overview

- Place injections within the crow's feet safety zone (Figs. 2A and 2B). The safety zone is 1 cm outside the orbital rim, above the level of the superior margin of the zygoma and extends under the eyebrow to the lateral limbus line. Botulinum toxin is concentrated within the central crow's feet safety zone, but injections may also be placed in the extended safety zone according to patients' anatomy.

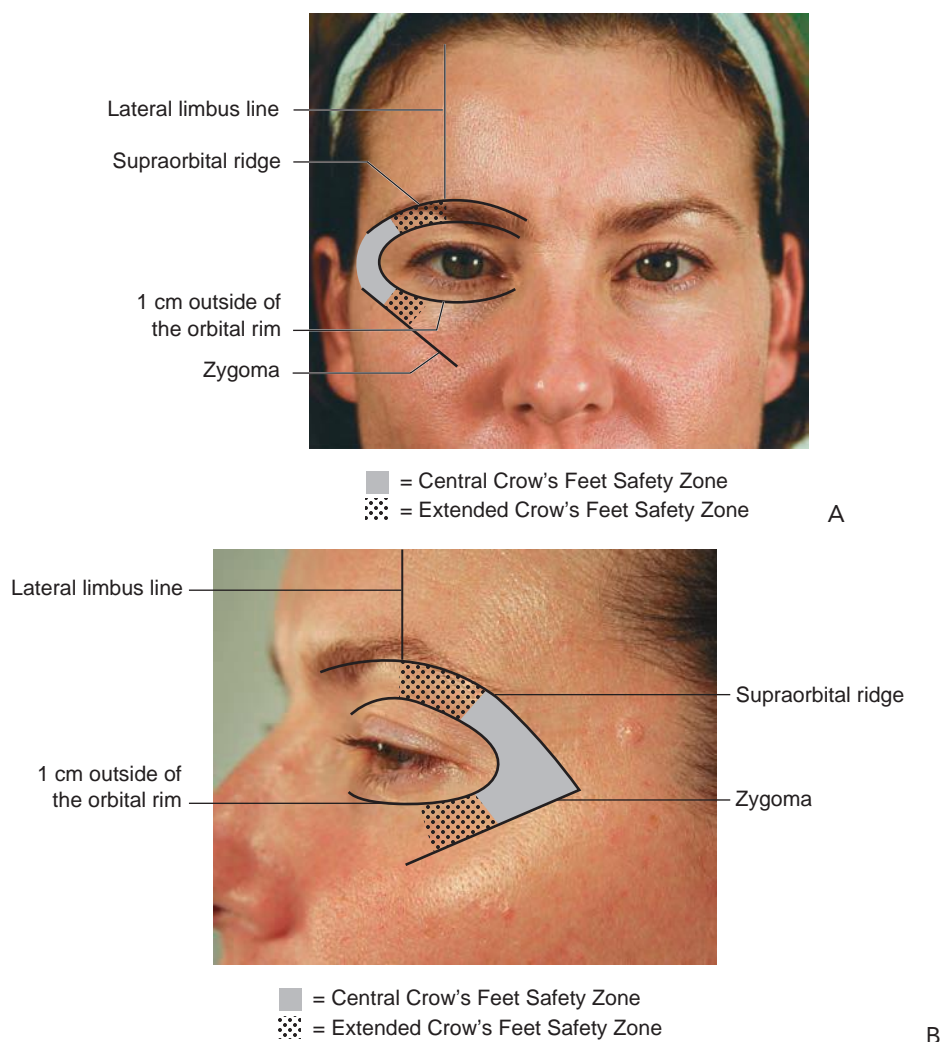


FIGURE 2 ● Crow's feet safety zone for botulinum toxin treatments: front (A) and lateral (B) views. Copyright R. Small, MD.

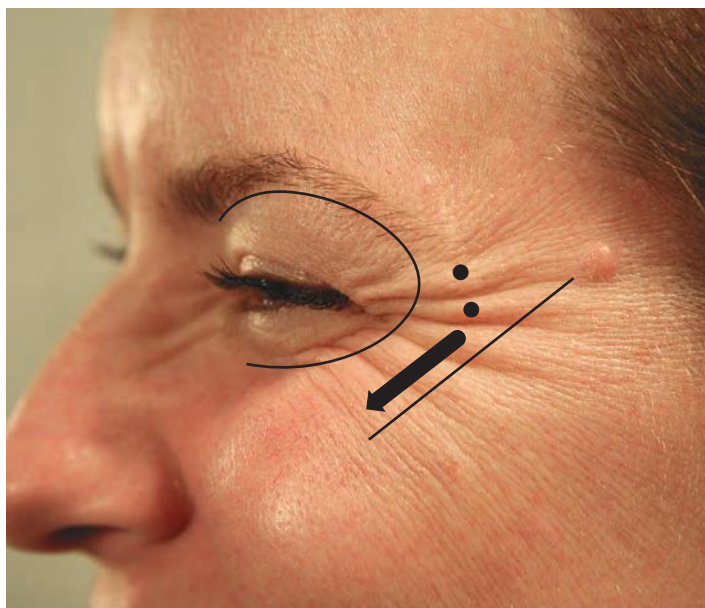


FIGURE 3 ● Overview of botulinum toxin injection points and doses for treatment of crow's feet. Copyright R. Small, MD.

- An overview of injection points and OBTX doses for treatment of crow's feet is shown in Figure 3. Injection points are located at the "ridges" of contracted muscle.
- Patterns of crow's feet vary; some extend superiorly toward the eyebrow and others extend inferiorly toward the cheek. Optimal treatment of the crow's feet is achieved by adapting the injection technique below to the patient's specific crow's feet pattern.
- Botulinum toxin is injected subdermally for treatment of crow's feet. It is important to place injections superficially in this region as the orbicularis oculi muscle overlies other muscles, which, if affected by botulinum toxin, can result in lip ptosis and other more serious complications. Subdermal injection can be achieved using the following technique: instruct the patient to contract the muscle in the treatment area by smiling and insert the needle just below the skin. Once the needle tip is inserted, instruct the patient to relax the muscle by slowly releasing their smile, and inject botulinum toxin to raise a visible wheal. The wheal is more visible at rest.
- The lateral canthal region has many veins and bruising is common. Veins are best seen and avoided using oblique lighting. If numerous vessels are visible in the treatment area, ecchymosis may be reduced by injecting a series of continuous wheals, where each injection is placed at the border of the previous wheal.
- Injecting superior to the crow's feet safety zone near the lateral limbus line at the orbital rim, can be associated with botulinum toxin migration into the levator muscles of the upper eyelid, resulting in blepharoptosis.

- Injecting medial to the crow's feet safety zone near the orbital rim at the lateral canthus, can be associated with deep migration of botulinum toxin into extraocular muscles, resulting in diplopia.
- Injecting deeply and inferior lateral to the crow's feet safety zone below the superior margin of the zygoma, may involve the lip levator muscles and increase the risk of cheek and lip ptosis, smile asymmetry, and possibly oral incompetence.
- Injecting deeply and inferior medial to the crow's feet safety zone may involve other lip levator muscles and increase the risk of cheek and lip ptosis, smile asymmetry, and profound oral incompetence.

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the crow's feet safety zone and palpate the orbital rim (Fig. 2).
3. Locate the orbicularis oculi muscle by instructing the patient to contract the muscles using one of the facial expressions above.
4. Identify the injection points (Fig. 3).
5. Prepare injection sites with alcohol and allow to dry.
6. The provider is positioned on the side that is to be injected.
7. While the lateral orbicularis oculi muscle is contracted, insert the needle 1 cm outside the orbital rim, near the lateral canthal line into the first injection point located at the muscle "ridge". The needle is inserted subdermally using the technique described earlier in the Procedure Overview. Inject 2.5 units of OBTX with gentle plunger pressure (Fig. 4).



FIGURE 4 ● First lateral orbicularis oculi muscle botulinum toxin injection. Copyright R. Small, MD.



FIGURE 5 ● Second lateral orbicularis oculi muscle botulinum toxin injection. Copyright R. Small, MD.

8. The second injection point is approximately 0.5 cm superior to the first injection point. Inject 2.5 units of OBTX (Fig. 5).
9. The third injection point is approximately 0.5 cm inferior to the first injection point. The needle is angled inferiorly and threaded superficially to the hub. Inject 2.5 units of OBTX as the needle is withdrawn (see Fig. 6).
10. Repeat injections for the contralateral orbicularis oculi muscle.
11. Compress the injection sites firmly, directing pressure away from the eye.



FIGURE 6 ● Third lateral orbicularis oculi muscle botulinum toxin injection. Copyright R. Small, MD.

Results

- **Reduction of dynamic crow's feet and lateral eyebrow elevation** is typically seen 3 days after botulinum toxin treatment, with maximal improvements at 1–2 weeks (see Figs. 1A and 1B).

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns 2.5–3 months after botulinum toxin treatment.
- Subsequent crow's feet treatments with botulinum toxin may be performed when the orbicularis oculi muscle begins to contract, before the lines return to their pretreatment appearance.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of crow's feet.

- **Persistent crow's feet.** If persistent crow's feet are present, evaluate for the following common causes:
 - **Orbicularis oculi muscle contraction.** Patients may have greater muscle mass than anticipated in the treatment area and additional botulinum toxin may be required to achieve desired results. Persistent muscle contraction can be corrected with a touch-up procedure using 2.5–10 units of OBTX, depending on the degree of orbicularis oculi muscle activity present. Reassess the treatment area 2 weeks after the touch-up procedure.
 - **Cheek muscle contraction.** Some patients will retain a few wrinkles inferior to the crow's feet treatment area, which are most noticeable with smiling (see Fig. 1B). These wrinkles are due to appropriately retained function of the zygomatic muscles and require no additional treatment.
 - **Static lines.** If static crow's feet are present, patients may require several consecutive botulinum toxin treatments for results to be seen. Combining botulinum toxin with other minimally invasive aesthetic procedures can offer enhanced results for treatment of static crow's feet (see Combining Aesthetic Treatments below).
- **Adjacent muscle involvement.** Some patients may complain of accentuated wrinkles in adjacent untreated areas, such as bunny lines on the nose, wrinkles under eyebrows or under the lower eyelids.
 - **Bunny lines** are readily treated with botulinum toxin in the nasalis muscle (see Bunny lines chapter).
 - **Lines under the eyebrow.** The infrabrow region contains the superior lateral orbicularis oculi muscle, which is not treated as part of botulinum toxin treatment for crow's feet. In some patients, wrinkles under the eyebrow may form due to compensatory contraction of this untreated portion of the orbicularis oculi muscle. Botulinum toxin may be directly placed in the superior lateral orbicularis oculi muscle to reduce these wrinkles (see Eyebrow Lift chapter).
 - **Lower eyelid wrinkles** can be due to several different causes, and a stepwise approach may be used to achieve improvement, which is outlined as follows:

- Lower eyelid wrinkles may result from compensatory contraction of the **medial preseptal orbicularis oculi muscle** after treatment of the crow's feet. Reducing the botulinum toxin dose at the third injection point may reduce lower eyelid wrinkles resulting from medial orbicularis oculi contraction.
- If this does not effect enough reduction in lower eyelid wrinkles, botulinum toxin may be placed directly in the **preseptal orbicularis oculi muscle** (see Lower Eyelid Wrinkles chapter).

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts section, Complications)
- Bruising
- Photophobia
- Lip ptosis with resultant smile asymmetry
- Oral incompetence with resultant drooling and impaired speaking, eating, or drinking
- Blepharoptosis (droopy upper eyelid)
- Diplopia (double vision)
- Lagophthalmos (incomplete eyelid closure)
- Impaired blink reflex
- Ectropion of the lower eyelid (eyelid margin eversion)
- Xerophthalmia (dry eye)
- Globe trauma

Bruising (ecchymosis) is the most common complication seen with treatment of crow's feet. Bruises can range in size from pinpoint needle insertion marks to quarter-sized bruises or hematomas, and if extravasated blood spreads, a "black eye" seen as a large infraocular ecchymotic crescent may occur. The time for resolution of a bruise depends on the patients' physiology and the size of the bruise. Larger bruises can be visible for 1–2 weeks. Prevention of bruising is preferable and several suggestions for bruise prevention are listed in the Introduction and Foundation Concepts section, Preprocedure Checklist. Immediate application of ice and pressure to a bruise can minimize bruising.

Photophobia is uncommon and when it occurs, is usually mild. It typically results from reduced squinting. Using sun protective measures such as sunglasses and hats can alleviate this problem.

Lip and cheek ptosis causing smile asymmetry and/or oral incompetence with resultant drooling and impaired speaking, eating, or drinking can occur with injections placed deeply and inferiorly, below the superior margin of the zygoma. The zygomaticus major lip levator muscle is most frequently involved as it is adjacent to the orbicularis oculi muscle and when affected, typically presents with lip and cheek ptosis similar to Bell's palsy, without oral incompetence. Patients who have undergone facial plastic surgery may be at increased risk of zygomaticus major involvement because of altered periocular anatomy.

Blepharoptosis is uncommon with crow's feet treatments and more commonly seen with frown line treatments. Botulinum toxin placed superiorly can migrate into the levator muscles of the upper eyelid causing blepharoptosis. See Frown Lines chapter, Complications for additional information on blepharoptosis and management strategies.

Impaired eyelid function and altered lower eyelid position, such as **ectropion** and **lagophthalmos**, are very rare and can occur with high botulinum toxin doses which excessively weaken the palpebral orbicularis oculi, or if botulinum toxin is placed too close to the eyelid. **Xerophthalmia**, which is extremely rare, can result from impaired eyelid function with reduced lacrimal flow, or may be secondary to ectropion and lagophthalmos. Patients who have had LASIK surgery may be more susceptible to xerophthalmia. **Diplopia** can occur with deep migration of botulinum toxin into extraocular muscles. **Globe trauma** is a risk with injections placed near the eye. Consultation with an ophthalmologist is advisable with any of these conditions to help in preventing corneal injury and other ocular complications.

Combining Aesthetic Treatments and Maximizing Results

- **Static crow's feet.** Botulinum toxin in the orbicularis oculi muscle can be combined with other minimally invasive aesthetic procedures to enhance static crow's feet results.
- **Dermal fillers.** Static crow's feet are shown in Figure 7, before (Fig. 7A) and after (Fig. 7B) combination treatment with botulinum toxin in the orbicularis oculi muscle and dermal filler treatment of the zygoma.



A



B

FIGURE 7 ● Static crow's feet before (A) and after (B) combination treatment with botulinum toxin in the orbicularis oculi muscle and dermal filler treatment of the zygoma. Copyright R. Small, MD.

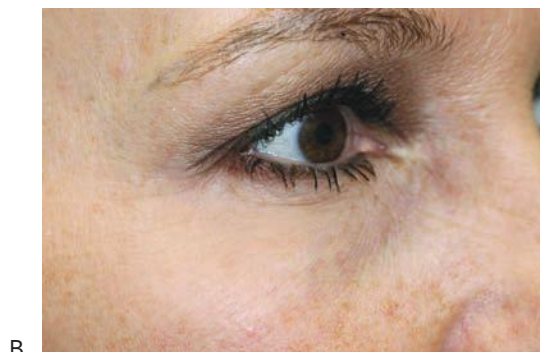


FIGURE 8 ● Static crow's feet before (A) and after (B) combination treatment with botulinum toxin in the orbicularis oculi muscle and periocular fractional ablative resurfacing. Copyright R. Small, MD.

- **Resurfacing procedures**, such as fractional ablative lasers or chemical peels. Static crow's feet are shown in Figure 8, before (Fig. 8A) and after (Fig. 8B) combination treatment with botulinum toxin in the orbicularis oculi muscle and periocular fractional ablative resurfacing.

Pricing

Charges for botulinum toxin treatment of crow's feet range from \$200–\$500 per treatment or \$10–\$25 per unit of OBTX.

Lower Eyelid Wrinkles

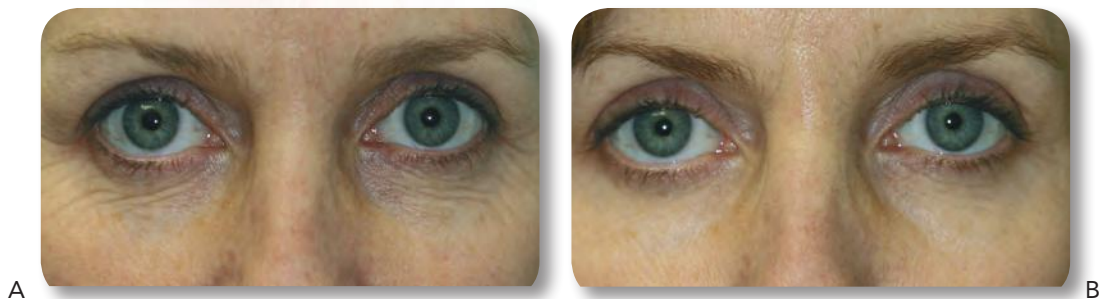


FIGURE 1 ● Infraocular lines before (A) and 1 month after (B) botulinum toxin treatment of the inferior orbicularis oculi muscle. Copyright R. Small, MD.

Contraction of the inferior portion of the orbicularis oculi muscle contributes to formation of lower eyelid wrinkles. Treatment of the inferior orbicularis oculi muscle with botulinum toxin focally inhibits contraction, which results in reduction of lower eyelid wrinkles and opening of the eye aperture.

Indications

- Lower eyelid wrinkles
- Palpebral aperture enlargement (i.e., the distance between upper and lower eyelid margins) and rounding of the eye shape
- Lower eyelid muscle bulge, also called a “jelly roll”

Contraindications

- See Introduction and Foundation Concepts section, Contraindications.
- Severe lower eyelid dermatochalasis (skin laxity).
- Abnormal snap test.
- Prominent infraorbital festoons (eye bags).

- Lagophthalmos (incomplete closure of eyelids).
- Excessive lower eyelid scleral show.
- Ectropion (eversion of eyelid margin).

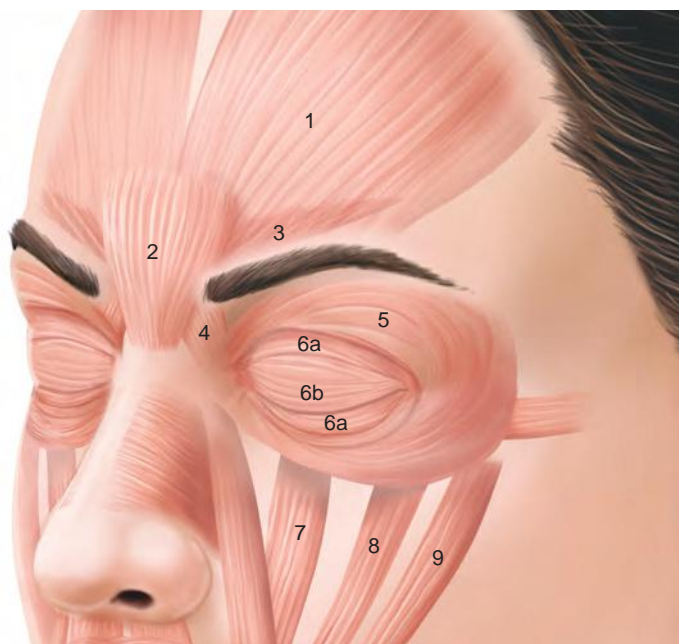
It is advisable to use caution in patients who have had previous lower eyelid surgery (e.g., blepharoplasty) or aggressive lower eyelid resurfacing (e.g., ablative laser resurfacing or deeper chemical peels) as they may exhibit lagophthalmos, excessive lower eyelid scleral show, or an ectropion, which contraindicate treatment with botulinum toxin.

Anatomy

- **Wrinkles.** Lower eyelid wrinkles, or infraocular rhytids, course horizontally and radiate inferior laterally away from the lower eyelid (Fig. 1A and 2B). They are often associated with a lower eyelid muscle bulge seen with animation, referred to as a “jelly roll” (Fig. 2A). Lower eyelid wrinkles occur with facial expressions and may be accentuated by botulinum toxin treatment of the crow’s feet.
- **Muscles targeted.** Lower eyelid wrinkle treatments with botulinum toxin target the preseptal orbicularis oculi muscle. The orbicularis oculi muscle has an orbital portion which surrounds the eye and a palpebral portion which covers the eye. The palpebral portion is further divided into the preseptal fibers, which course in front of the orbital septum, and the pretarsal fibers, which form the eyelids (Fig. 3).



FIGURE 2 ● Lower eyelid dynamic wrinkles and muscle bulge (A) and static wrinkles (B). Copyright R. Small, MD.



- | | |
|---|---|
| 1. Frontalis m. | 6. Orbicularis oculi m. (palpebral portion) |
| 2. Procerus m. | a. Preseptal |
| 3. Corrugator supercilii m. | b. Pretarsal |
| 4. Depressor supercilii m. | 7. Levator labii superioris m. |
| 5. Orbicularis oculi m. (orbital portion) | 8. Zygomaticus minor m. |
| | 9. Zygomaticus major m. |

FIGURE 3 ● Periocular detailed anatomy. Copyright R. Small, MD.

- **Muscle functions.** Contraction of several different muscles and muscle regions can contribute to formation of lower eyelid wrinkles including the: preseptal orbicularis oculi medial to the mid pupillary line, preseptal orbicularis oculi lateral to the mid pupillary line, and lip levators such as zygomaticus major and levator labii superioris which primarily functions as a lip levator. A lower eyelid muscle bulge is due to contraction of the palpebral portion of the orbicularis muscle.

Patient Assessment

- **Facial surgery** history is obtained, including blepharoplasty and skin resurfacing procedures such as ablative laser resurfacing or deep chemical peels of the lower eyelids. Ophthalmologic history including keratorefractive surgery (LASIK) is obtained as these patients may have a greater risk of dry eyes.
- **Dynamic** (with muscle contraction) assessments of the lower eyelid are made including:
 - **Lower eyelid wrinkles** are evaluated while having the patient perform one of the facial expressions listed below (Fig. 2A). The botulinum toxin injection techniques described in this chapter can reduce lower eyelid wrinkles at or lateral to the mid pupillary line. They do not reduce lower eyelid wrinkles medial to the mid pupillary line.
 - **Lower eyelid wrinkles muscle bulge** is also assessed while the patient is contracting the lower eyelid muscles (Fig. 2A). Botulinum toxin injection of the lower



FIGURE 4 ● Laxity of the lower eyelid is a contraindication to botulinum toxin treatment of the lower eyelid. Copyright R. Small, MD.

eyelid can soften this muscle bulge and increase the palpebral aperture, which can widen and round the eye shape.

- **Static** (at rest) assessments of the lower eyelid are made including:
 - **Static lower eyelid wrinkles** are assessed with the face at rest (Fig. 2B).
 - **Skin laxity** of the lower eyelids may be clinically evident as wrinkles and folds of skin in the lower eyelid area (Fig. 4). Botulinum toxin treatment of the lower eyelid may exacerbate these wrinkles and treatment should be avoided in patients with obvious skin laxity. Surgery is often required to improve lower eyelid wrinkles due to severe skin laxity.
 - **Elasticity of the lower eyelids** is assessed using the **snap test**. It is performed by grasping the skin of the lower eyelid between the thumb and the first finger, pulling the skin gently away from the eye and releasing (Fig. 5). If the skin recoils immediately, the snap test is normal and botulinum toxin treatment may be performed. If the skin recoils slowly (more than 3 seconds), the lower eyelid has insufficient elasticity and should not be treated with botulinum toxin.



FIGURE 5 ● Snap test for evaluation of lower eyelid elasticity. Copyright R. Small, MD.



FIGURE 6 ● Infraorbital festoons are a contraindication to botulinum toxin treatment of the lower eyelids. Copyright R. Small, MD.

- **Infraorbital festoons**, or lower eye bags, are soft tissue bulges, which are visible at rest (Fig. 6). The orbital septum, which is a facial layer that helps to retain infraorbital fat pads, weakens with age. Eye bags are typically due to bulging of the infraorbital fat pad as a result of a weakened orbital septum. The orbicularis oculi also supports the inferior orbital septum and weakening of this muscle with botulinum toxin may exacerbate festooning. Treatment should be avoided in patients with eye bags.
- **Scleral show** refers to the crescent of white sclera visible between the iris and the lower eyelid margin at rest with forward level gaze. Scleral show is due to lower lid retraction and, while a small amount of sclera show is common and a normal finding, excessive sclera show of more than 2 mm is a contraindication to botulinum toxin treatment of the lower eyelid.
- **Lagophthalmos** is incomplete closure of eyelids and can be assessed by instructing the patient to “roll their eyes upwards” while trying to keep their eyelids closed. Figure 7 shows a patient with a history of a blepharoplasty demonstrating lagophthalmos with upward gaze. This is a contraindication to botulinum toxin treatment of the lower eyelids.



FIGURE 7 ● Incomplete eyelid closure (lagophthalmos), shown in a patient with a history of a blepharoplasty, is a contraindication to botulinum toxin treatment of the lower eyelids. Copyright R. Small, MD.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform any of the following expressions:

- “Make a cheesy grin” or “make a big smile”
- “Squint like the sun is in your eyes”

Treatment Goal

- Partial inhibition of the inferior orbicularis oculi muscle.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved sterile saline (see Introduction and Foundation Concepts section, Reconstitution Method).
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women and men: total (bilateral) dose is 2.5 units of OBTX

Anesthesia

- Anesthesia with ice is not recommended because it vasoconstricts and can obscure blood vessels.

Equipment for Treatment

- General botulinum toxin supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30- or 32-gauge 0.5-inch needle

Procedure Overview

- An overview of injection points and OBTX doses for treatment of lower eyelid wrinkles is shown in Figure 8. Two injections are usually performed for each eye, one medial (Fig. 8A) and one lateral (Fig. 8B). Providers getting started with botulinum toxin injections may choose to start with injection of the medial point only (Fig. 8A), to reduce the risk of complications.
- Botulinum toxin is injected subdermally for treatment of lower eyelid wrinkles. These injections require a light touch as the orbicularis oculi muscle is a superficial muscle and the lower eyelid skin is very thin.
- For patients with long eyelashes that obscure the medial injection point instruct them to “roll their eyes upward” while keeping their eyelids closed when performing this injection.
- The inferior eyelid region has many tiny veins, which are best seen and avoided using oblique lighting.

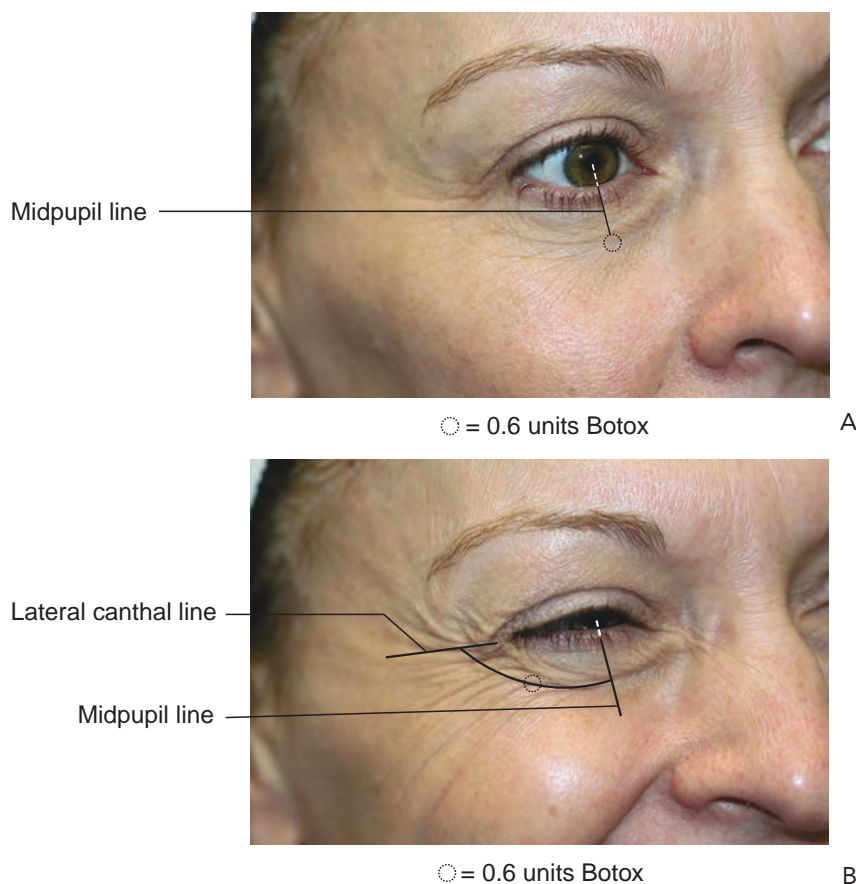


FIGURE 8 ● Overview of botulinum toxin injection points and doses for treatment of lower eyelid wrinkles. The medial injection is placed with the muscles at rest (**A**) and the lateral injection is placed during orbicularis oculi muscle contraction (**B**). Copyright R. Small, MD.

- Injecting superiorly may involve the pretarsal orbicularis oculi muscle and increase the risk of lower eyelid ectropion and lagophthalmos.

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify facial landmarks. Palpate the orbital rim (Fig. 9). Identify the lateral canthal and midpupillary lines (Fig. 8).
3. Prepare injection sites with alcohol and allow them to dry.
4. The provider is positioned on the side that is to be injected.
5. **Medial lower eyelid injection.** The medial lower eyelid injection is located in the midpupillary line, 0.5 cm inferior to the eyelid margin (Fig. 8A). While the muscles are at rest and patient's eyes are closed, angle the needle medially, almost parallel to the skin, and insert the needle tip subdermally just under the skin. Inject 0.6 units of OBTX to raise a wheal (Fig. 10).
6. **Lateral lower eyelid injection.** The lateral lower eyelid injection point is located midway between the first injection point and the lateral canthal line, 1 cm inferior to



FIGURE 9 ● Palpation of the infraorbital rim. Copyright R. Small, MD.

the eyelid margin (Fig. 8B). While the orbicularis oculi muscle contracted, angle the needle inferiorly, almost parallel to the skin, and insert the needle subdermally just under the skin. Inject 0.6 units of OBTX to raise a wheal (Fig. 11).

7. Repeat injections for the contralateral inferior orbicularis oculi muscle.
8. Compress the injection sites, directing pressure away from the eye.



FIGURE 10 ● Medial botulinum toxin injection of the inferior orbicularis oculi muscle. Copyright R. Small, MD.



FIGURE 11 ● Lateral botulinum toxin injection of the inferior orbicularis oculi muscle. Copyright R. Small, MD.

Results

- **Reduction of lower eyelid wrinkles, “jelly rolls”, and eye aperture enlargement** are typically seen 3 days after botulinum toxin treatment, with maximal improvements at 1–2 weeks (Figs. 1A and 1B). Unlike with botulinum toxin treatments in other regions of the face, both static and dynamic lower eyelid wrinkles usually respond well to treatment.

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns 2.5–3 months after botulinum toxin treatment.
- Subsequent lower eyelid treatments with botulinum toxin may be performed when the orbicularis oculi muscle begins to contract, before lines and wrinkles return to their pretreatment appearance.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of lower eyelid wrinkles and eyelid position. Persistent lower eyelid wrinkles are often due to one of the following reasons:

- **Deep static wrinkling.** If static wrinkles are present, patients may require several consecutive botulinum toxin treatments for results to be seen. Botulinum toxin doses are not routinely escalated in the lower eyelid region because of the increased risk of complications with higher doses. Combining botulinum toxin with other minimally invasive aesthetic procedures can offer enhanced results for treatment of static lower eyelid wrinkles (see Combining Aesthetic Treatments on next page).

- **Adjacent muscle involvement.** In some patients, lower eyelid wrinkles result from upward movement of the cheek due to contraction of the zygomaticus and/or levator labii superioris muscles. These patients will not benefit from botulinum toxin treatment of the lower eyelid.

Complications and Management

- General Injection-Related Complications (see Introduction and Foundation Concepts, Complications)
- Worsening infraocular festooning (eye bags)
- Lagophthalmos (incomplete eyelid closure)
- Impaired blink reflex
- Ectropion of the lower eyelid (eyelid margin eversion)
- Xerophthalmia (dry eyes)
- Globe trauma
- Epiphora (tearing)

Infraocular festoons may worsen due to botulinum toxin injection in the lower eyelid area due to weakening of the inferior orbicularis oculi muscle and/or impaired lymphatic drainage.

Impaired eyelid function and **altered eyelid position**, such as **ectropion** and **lagophthalmos**, are very rare and can occur with high botulinum toxin doses excessively weakening the palpebral orbicularis oculi or if botulinum toxin is placed too close to the eyelid. One study (Flynn, 2003) suggests that botulinum toxin placed in the lateral palpebral orbicularis oculi muscle injection point described earlier, may be associated with an increased risk of ectropion.

Xerophthalmia, which is extremely rare, can result from impaired eyelid function with reduced lacrimal flow or may be secondary to ectropion and lagophthalmos. Patients who have had LASIK surgery may be more susceptible to xerophthalmia. **Epiphora** may result from lacrimal dysfunction, if botulinum toxin is placed medial to the midpupillary line. **Globe trauma** is a risk as injections in the lower eyelid area are usually superior to the bony orbital rim.

There are no corrective treatments for most of these complications; however, they will spontaneously resolve as botulinum toxin effects diminish. Consultation with an ophthalmologist is advisable with any of these complications.

Combining Aesthetic Treatments and Maximizing Results

- **Static lower eyelid wrinkles.** Combination therapy with resurfacing procedures such as fractional ablative lasers or chemical peels, together with botulinum toxin in the inferior orbicularis oculi muscle, can enhance static lower eyelid wrinkle results.

Pricing

Treatment of lower eyelid wrinkles is typically performed concomitantly with treatment of the crow's feet. This is an advanced botulinum toxin treatment area and charges range from \$50–\$60 per unit of OBTX.

Eyebrow Lift



FIGURE 1 ● Eyebrow lift before (A) and 2 weeks after (B) botulinum toxin treatment of the infrabrow orbicularis oculi muscle in a patient also receiving botulinum toxin treatment of the glabellar complex muscles for frown line treatment, at rest. Copyright R. Small, MD.

Low-positioned eyebrows (eyebrow ptosis) and upper eyelid skin laxity (dermatochalasis) convey a tired or sad appearance and are accentuated by contraction of the superior lateral orbicularis oculi muscle. These conditions can often be improved with botulinum toxin treatment of the superior lateral orbicularis oculi which inhibits muscle contraction resulting in lateral eyebrow elevation, also called a chemical brow lift or eyebrow lift. Treatment of other muscle groups in the upper face can also elevate eyebrows (see Combining Aesthetic Treatments at the end of this chapter), however, botulinum toxin treatment of the superior lateral orbicularis oculi muscle is the focus of this chapter.

Indications

- Lateral eyebrow ptosis
- Upper eyelid dermatochalasis
- Lateral eyebrow lift

Anatomy

- **Eyebrow position and shape.** In women, ideal eyebrow position is slightly above the supraorbital ridge and that the brow has an arched, tapering gull-wing shape (Fig. 2A).

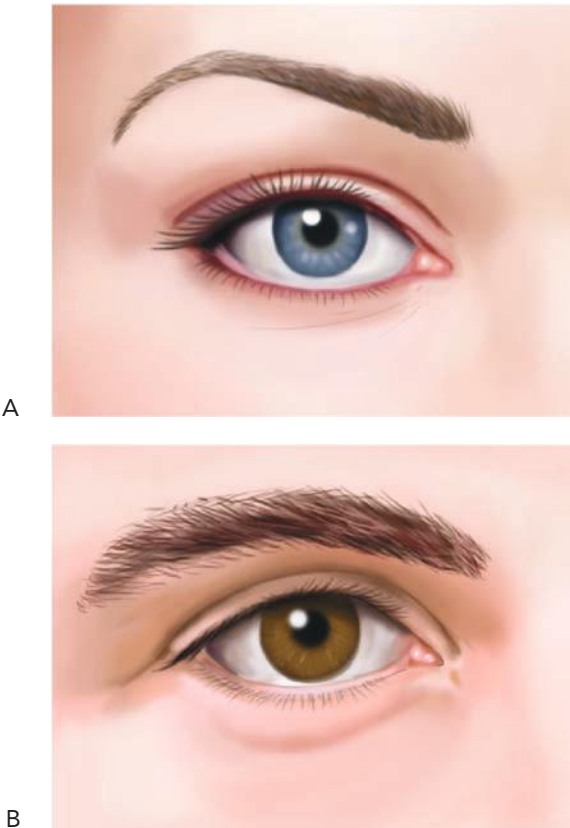


FIGURE 2 ● Eyebrow shapes: women **(A)** and men **(B)**. Copyright R. Small, MD.

- In men, eyebrows are positioned at the supraorbital ridge and are horizontal in shape (Fig. 2B).
- **Muscles targeted.** Lateral eyebrow lift with botulinum toxin targets the superior lateral orbital portion of the orbicularis oculi muscle. Other muscles in the upper face affecting eyebrow height position and are listed in Table 1.

TABLE 1

Eyebrow Height and Position: Effects of Muscle Contraction and Botulinum Toxin Treatments

Muscle	Muscle Contraction Effect on Eyebrow	Botulinum Toxin Effect on Eyebrow
Glabellar complex	Medial eyebrow depressor	Elevates medial eyebrow
Superior lateral orbicularis oculi	Lateral eyebrow depressor	Elevates lateral eyebrow
Lateral orbicularis oculi	Lateral eyebrow depressor	Elevates lateral eyebrow
Frontalis	Medial and lateral eyebrow levator	Lowers medial and lateral eyebrow



FIGURE 3 ● Superior lateral orbicularis muscle targeted with botulinum toxin eyebrow lift treatments. Copyright R. Small, MD.

- **Muscle functions.** Contraction of the superior lateral orbicularis oculi muscle lowers the lateral eyebrow, and aids in closure of the eyelid and lacrimal function (see Anatomy section, Figs. 1 and 2).

Patient Assessment

- **Eyebrow ptosis** and **dermatochalasis** (hooding) are assessed with the frontalis muscle at rest. Patients with severe dermatochalasis who have excessive folds of lax skin resting on the upper eyelid, or significant eyebrow ptosis, typically do not show marked improvement with lateral eyebrow lifting and may require surgical interventions such as blepharoplasty and a forehead lift, respectively.
- **Strength of the superior lateral orbicularis oculi muscle** is assessed by placing the index finger beneath this portion of the muscle and having the patient contract the muscle (Fig. 3). If the patient can exert forceful pressure against the finger with a visible roll of contracted muscle, the eyebrow lift procedure will typically yield noticeable elevation of the lateral eyebrow.

Eliciting Contraction of the Muscles to Be Treated

Instruct the patient to perform the following expression:

- “Blink hard and hold it”

Treatment Goal

- Partial inhibition of the superior lateral orbicularis oculi muscle.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts section, Reconstitution Method).

- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women: total (bilateral) dose is 5–7.5 units of OBTX.
- Men: total (bilateral) dose is 7.5–10 units of OBTX.

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

Procedure Overview

- Place injections in the eyebrow lift safety zone (Fig. 4). The safety zone is at least 1 cm outside the orbital rim, below the supraorbital ridge and lateral to the lateral limbus line.
- An overview of injection points and OBTX doses for a lateral eyebrow lift is shown in Figure 5.
- Botulinum toxin is injected intramuscularly with the eyebrow lift procedure.
- Injecting superior lateral to the safety zone may involve the frontalis muscle, resulting in eyebrow ptosis.
- Injecting superior medial to the safety zone at the lateral limbus line may involve eyelid levator muscles, resulting in blepharoptosis (droopy upper eyelid).

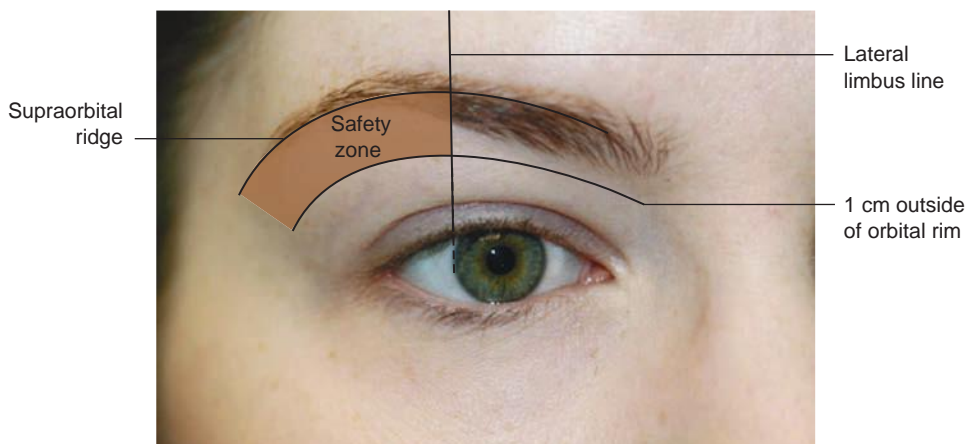


FIGURE 4 ● Eyebrow lift safety zone for botulinum toxin treatments. Copyright R. Small, MD.

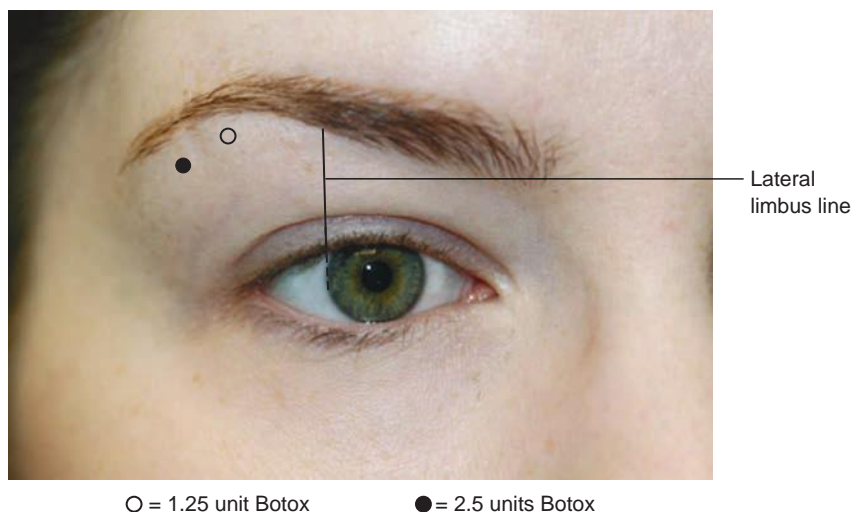


FIGURE 5 ● Overview of botulinum toxin injection points and doses for lateral eyebrow lift. Copyright R. Small, MD.

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the eyebrow lift safety zone (Fig. 4).
3. Identify the superior lateral portion of the orbicularis oculi muscle by instructing the patient to contract the muscle as described above and visualizing/palpating the roll of contracted muscle (Fig. 3).
4. Identify the injection points (Fig. 5).
5. Ice for anesthesia (optional).
6. Prepare injection sites with alcohol and allow to dry.
7. The provider is positioned on the side that is to be injected.



FIGURE 6 ● Lateral eyebrow lift botulinum toxin injection technique. Copyright R. Small, MD.

8. While the orbicularis oculi muscle is relaxed, insert the needle in the first injection point located approximately 1.5 cm lateral to the lateral limbus line, within the safety zone (Fig. 6). Angle the needle towards the forehead and insert subdermally. Inject 2.5 units of OBTX.
9. The second injection point is 1 cm medial to the first injection point, closer to the lateral limbus line. Insert the needle similarly and inject 1.25 units of OBTX.
10. Repeat the above injections for the contralateral side of the face.
11. Compress the injection sites firmly, directing pressure away from the eye.

Results

- **Lateral eyebrow elevation** is typically noticeable 1–2 weeks after botulinum toxin treatment (Figs. 1A and 1B).

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns 2–3 months after botulinum toxin treatment.
- Eyebrow lifting is subtle and determining when to return for treatment can be challenging for patients. Subsequent treatments may be performed when eyebrow descent is noticeable or when patients notice recurrence of eyelid heaviness or a fatigued appearance. The author typically performs an eyebrow lift every 3–4 months with the same time intervals as other upper face botulinum toxin treatments.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of eyebrow ptosis. If more lateral eyebrow elevation is desired, assess the strength of the superior lateral orbicularis oculi muscle. If significant contractility is still present, additional OBTX may be injected in the same areas previously treated. Total bilateral doses for this touch-up procedure are usually 2.5–5 units of OBTX.

Complications and Management

- General injection-related complications (see Botulinum Toxin Introduction and Foundation Concepts section, Complications topic)
- Blepharoptosis

Blepharoptosis may occur as a complication from eyebrow lift treatments, particularly if botulinum toxin is injected too close to the supraorbital ridge at the lateral limbus line. Blepharoptosis results from migration of botulinum toxin through the orbital septum fascia to the levator palpebrae superioris muscle in the upper eyelid (See Frown Lines chapter for treatment of blepharoptosis).

Combining Aesthetic Treatments and Maximizing Results

Eyebrow position and height can be optimized by combining a lateral eyebrow lift with the following procedures:

- **Botulinum toxin.** Treatments in other muscles of the upper face can enhance eyebrow elevation, including:
 - Glabellar complex muscles (see Frown Lines chapter) for additional medial eyebrow elevation.
 - Lateral orbicularis oculi muscle (see Crow's Feet chapter) for additional lateral eyebrow elevation.
 - Frontalis muscle, using the "V-shaped" injection pattern (see Horizontal Forehead Lines chapter) for additional lateral eyebrow elevation.
- **Dermal fillers.** Lateral eyebrow elevation can also be augmented by combining botulinum toxin lateral eyebrow lift with infrabrow dermal filler treatments.

Pricing

Charges for botulinum toxin eyebrow lift treatments range from \$150–\$200 per treatment or \$10–\$25 per unit of OBTX.

Bunny Lines

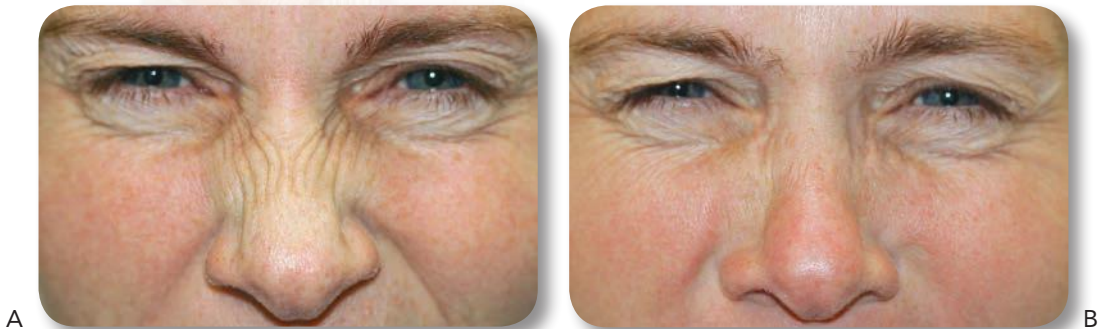


FIGURE 1 ● Bunny lines before (A) and 2 weeks after (B) botulinum toxin treatment of the nasalis muscle, with active nasal scrunching. Copyright R. Small, MD.

Dynamic bunny lines result from contraction of the nasalis muscle. They are part of facial expressions such as frowning, squinting, or smiling and may also be accentuated by botulinum toxin treatments in the upper face for frown lines and crow's feet. Botulinum toxin treatment of the nasalis reduces bunny lines by inhibiting muscle contraction and smoothing the overlying skin.

Indication

- Bunny lines

Anatomy

- **Wrinkles.** Bunny lines, or nasalis rhytids, are wrinkles formed on the lateral and dorsal aspects of the nose. They typically course diagonally over the nasal sidewalls and nasal bridge (Fig. 1A and see Anatomy section, Figs. 4 and 5). Transverse lines across the root of the nose are not related to the nasalis muscle but rather are due to contraction of the procerus muscle seen with frowning (Fig. 2).
- **Muscles targeted.** Botulinum toxin bunny line treatment targets the nasalis muscle (see Anatomy section, Figs. 1 and 2).



FIGURE 2 ● Transverse nasal lines due to contraction of the procerus muscle. Copyright R. Small, MD.

- **Muscle functions.** Nasalis contraction draws the nasal sidewalls superiorly and medially, producing bunny lines (see Anatomy section, Fig. 7). In some individuals this also leads to fine medial infraocular lines.
- **Muscles avoided.** The levator labii superioris alaeque nasi muscle that lies on the lateral border of the nasalis muscle can also contribute to formation of bunny lines. This is primarily an upper lip levator and, as with other lip levators, it is avoided with treatment of bunny lines. Other upper lip levator muscles that are avoided with botulinum toxin treatment of bunny lines include, in order of medial to lateral location, levator labii superioris, zygomaticus minor, and zygomaticus major (see Anatomy section, Fig. 3).

Patient Assessment

- **Dynamic** (with muscle contraction) and **static** (at rest) **bunny lines** are assessed.
- **Concomitant contraction of the nasalis, glabellar and/or orbicularis oculi muscles** during facial animation are assessed. Patients that form bunny lines with these other facial expressions will benefit from botulinum toxin treatment of bunny lines concomitantly with these other facial areas.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform the following expression:

- “Think of a bad skunk smell”

Treatment Goal

- Complete inhibition of the nasalis muscle.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts section, Reconstitution Method).

- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women and men: 2.5–5 units of OBTX

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

Procedure Overview

- Place injections within the bunny line safety zone (Figs. 3A and 3B). The safety zone is a diamond-shaped region with the superior point of the diamond located at the nasion (the least protruding part of the nose between the medial canthi) and the inferior point located halfway between the nasion and nasal tip. The lateral diamond points lie along the nasion-ala line. The nasion-ala line is drawn from the edge of the nasal ala inferiorly and intersects the intercanthal line superiorly.
- An overview of injection points and OBTX doses for treatment of bunny lines is shown in Figure 4.
- Botulinum toxin is injected intramuscularly for treatment of bunny lines.
- Injecting lateral to the safety zone may involve the labii superioris alaeque nasi muscle, resulting in upper lip ptosis (droopy upper lip).
- Injecting superior lateral to the safety zone may involve the medial palpebral orbicularis oculi, which can disrupt lacrimal drainage resulting in epiphoria (excessive tearing).
- Injecting superior to the safety zone may involve the procerus muscle and does not target the nasalis muscle.

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the bunny line safety zone (Fig. 3).
3. Locate the nasalis muscles by instructing the patient to contract the muscles using one of the facial expression above.
4. Identify the injection points (Fig. 4).
5. Ice for anesthesia (optional).
6. Prepare injection sites with alcohol and allow to dry.
7. The provider is positioned on the side that is to be injected.
8. While the nasalis muscle is contracted, insert the needle just medial to the nasion-ala line located on the lateral nasal wall within the safety zone (Fig. 5). Angle

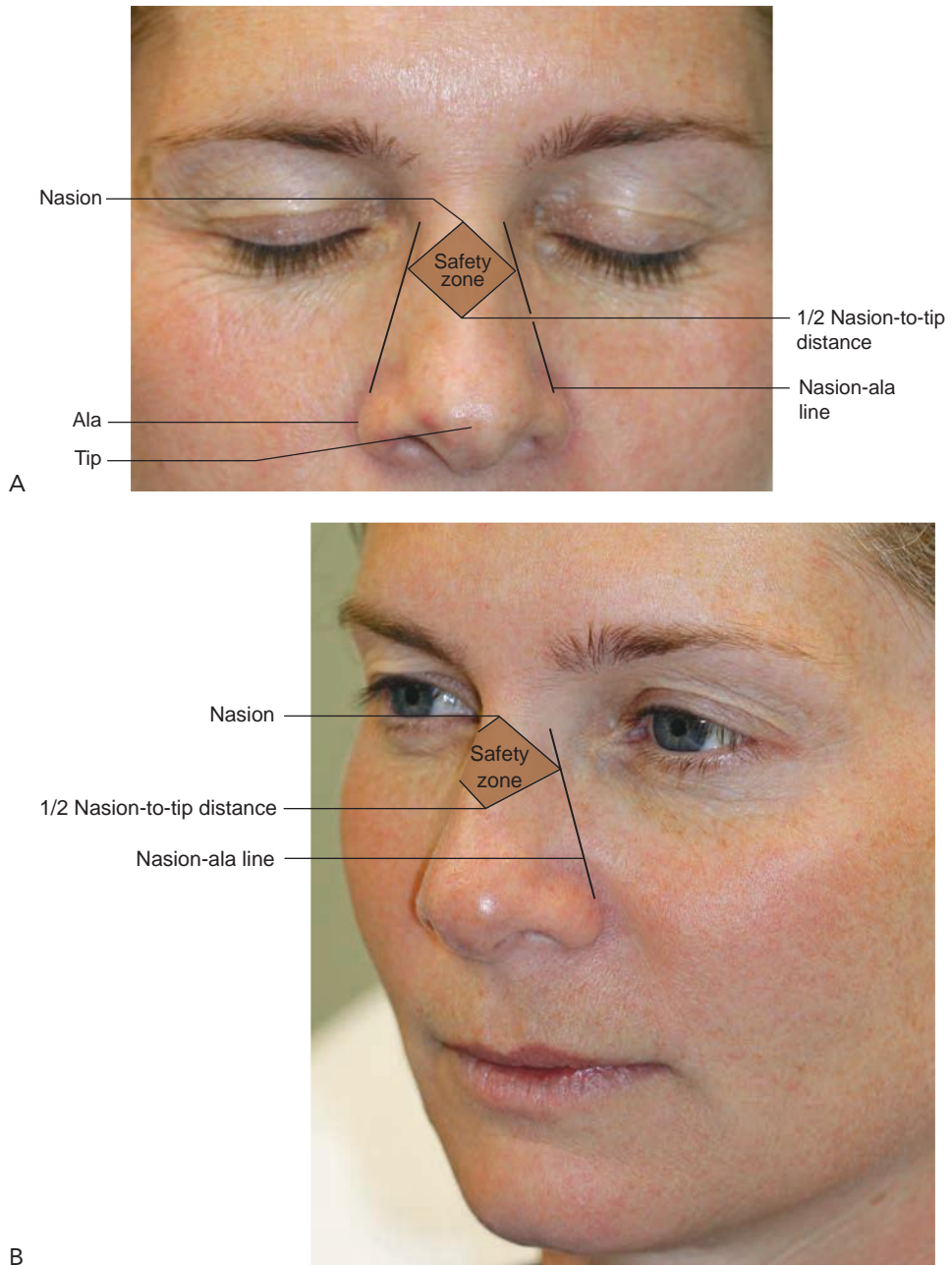
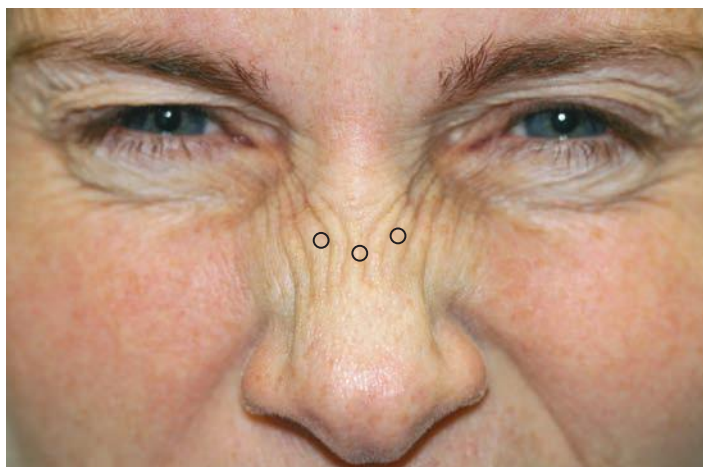


FIGURE 3 ● Bunny line safety zone for botulinum toxin treatments: anterior-posterior (**A**) and oblique (**B**) views. Copyright R. Small, MD.



○ = 1.25 units Botox

FIGURE 4 ● Overview of botulinum toxin injection points and doses for treatment of bunny lines. Copyright R. Small, MD.

the needle towards the nasal sidewall and insert subdermally. Inject 1.25 units of OBTX.

9. Repeat the above injection on the contralateral nasal wall.
10. The third injection point is on the dorsum of the nose. Reposition to stand in front of the patient. With the nasalis muscle contracted, approach inferiorly,



FIGURE 5 ● Nasalis muscle sidewall botulinum toxin injection technique. Copyright R. Small, MD.



FIGURE 6 ● Nasalis muscle dorsum botulinum toxin injection technique. Copyright R. Small, MD.

angling the needle toward the dorsum of the nose, and inject 1.25 units of OBTX (Fig. 6).

11. Compress injection wheals medially.

Results

- **Reduction of dynamic bunny lines** is typically seen 3 days after botulinum toxin treatment, with maximal reduction at 2 weeks (Figs. 1A and 1B).

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns 3–4 months after botulinum toxin treatment.

- Subsequent bunny line treatments with botulinum toxin may be performed when the nasalis muscle begins to contract, before the lines return to their pretreatment appearance.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduced bunny lines. If persistent bunny lines are present, evaluate for one of the following common causes:

- **Persistent nasalis muscle contraction.** Some patients may have greater muscle mass than anticipated in the treatment area and additional botulinum toxin may be required to achieve desired results. Persistent muscle contraction can be corrected with a touch-up procedure using 1.25–2.5 units of OBTX, depending on the degree of nasalis muscle activity present.
- **Static lines.** If static lines are present, patients may require several consecutive treatments for results to be seen.

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts section, Complications)
- Lip ptosis with resultant smile asymmetry
- Oral incompetence with resultant drooling and impaired speaking, eating, or drinking
- Epiphoria
- Diplopia

Most complications with bunny line treatments occur if injections are placed laterally along the nasal sidewall, such that botulinum toxin affects the lip levator muscles. These complications can range from mild **lip ptosis** and **smile asymmetry** due to involvement of the levator labii superioris alaeque nasi, to more serious functional impairments resulting from **oral incompetence** such as drooling, impaired speech, and difficulty eating or drinking, due to involvement of zygomaticus and levator labii superioris lip levator muscles.

Epiphoria can result from impaired lacrimal drainage if the medial palpebral portion of the orbicularis oculi is affected. With injections near the lateral canthus, diffusion to extraocular muscles can result in **diplopia**.

There are no corrective treatments for most of these complications; however, they will spontaneously resolve as botulinum toxin effects diminish. With any of these conditions, consultation with an ophthalmologist is advisable to help prevent corneal injury and other ocular complications.

Combining Aesthetic Treatments and Maximizing Results

- Treatment of bunny lines is often performed concomitantly with botulinum toxin treatment of frown lines or crow's feet (see Frown Lines and Crow's Feet chapters).

Pricing

Charges for botulinum toxin treatment of bunny lines range from \$150–\$200 per treatment or \$10–\$25 per unit of OBTX.

Lip Lines

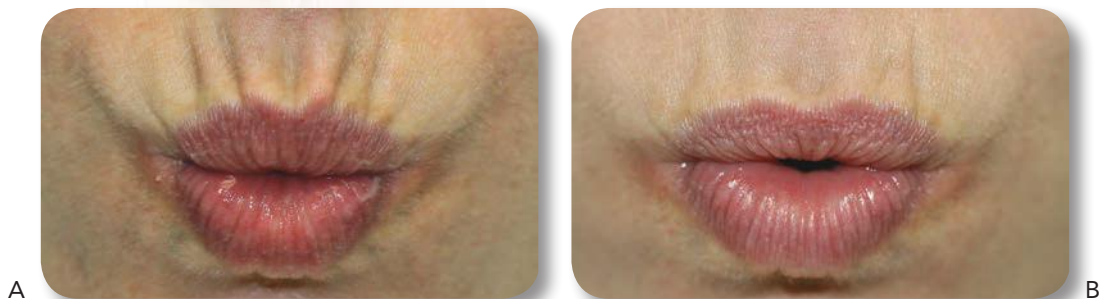


FIGURE 1 ● Upper lip lines before (A) and 2 weeks after (B) botulinum toxin treatment of the upper orbicularis oris muscle, with active muscle contraction. Copyright R. Small, MD.

Dynamic lip lines result from contraction of the perioral musculature, primarily the orbicularis oris muscle. Botulinum toxin treatment of the orbicularis oris reduces lip lines by inhibiting muscle contraction and smoothing the overlying skin. Treatment of the orbicularis oculi muscle also increases lip eversion resulting in a fuller lip appearance. Upper lip lines are a common complaint and, while safety zones and injection points for both upper and lower lips are discussed, the focus of this chapter is botulinum toxin treatment of the upper lip.

Indications

- Radial lip lines
- Enhanced lip fullness

Anatomy

- **Wrinkles.** Lip lines, medically referred to as perioral rhytids and commonly referred to as lipstick lines or smoker's lines, are wrinkles that extend radially from the upper and lower lip borders (see Anatomy section, Figs. 4 and 5).

- **Muscles targeted.** Botulinum toxin lip line treatment targets the orbicularis oris, a sphincteric muscle that encircles the mouth.
- **Muscle functions.** The orbicularis oris muscle functions to draw the lips medially and to invert the lip border (see Anatomy section, Fig. 7 and Table 1). Adequate strength of the orbicularis oris muscle is required for facial expressions such as smiling and puckering as well as the essential functions of speaking, kissing, eating, and drinking.
- **Muscles avoided.** Many muscles of the middle and lower face insert and exert effects on the lips and most of these muscles lie deep to the orbicularis oris muscle. Upper lip levator muscles avoided with botulinum toxin treatment of lip lines include: levator labii superioris alaeque nasi, levator labii superioris, zygomaticus minor, zygomaticus major, and levator anguli oris (see Anatomy section, Fig. 3).

Patient Assessment

- **Social history** is obtained including occupations/activities necessitating full oral competence, such as wind instrument musicians, actors, singers, and public speakers.
- **Dynamic** (with muscle contraction) and **static** (at rest) **lip lines** are assessed.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform any of the following expressions:

- “Whistle”
- “Sip on a straw”
- “Pucker”

Treatment Goal

- Partial inhibition of the upper lip orbicularis oris muscle to reduce lip lines with avoidance of the philtral area to maintain a desirable lip shape.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts section, Reconstitution Method).
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women and men: total (bilateral) dose is 3.75–5 units of OBTX for the upper lip

Anesthesia

- The upper lip is very sensitive and anesthesia is required. Topical anesthetics reduce motor function in the applied area, and therefore, are applied after evaluating the area for dynamic wrinkling and taking photographs.

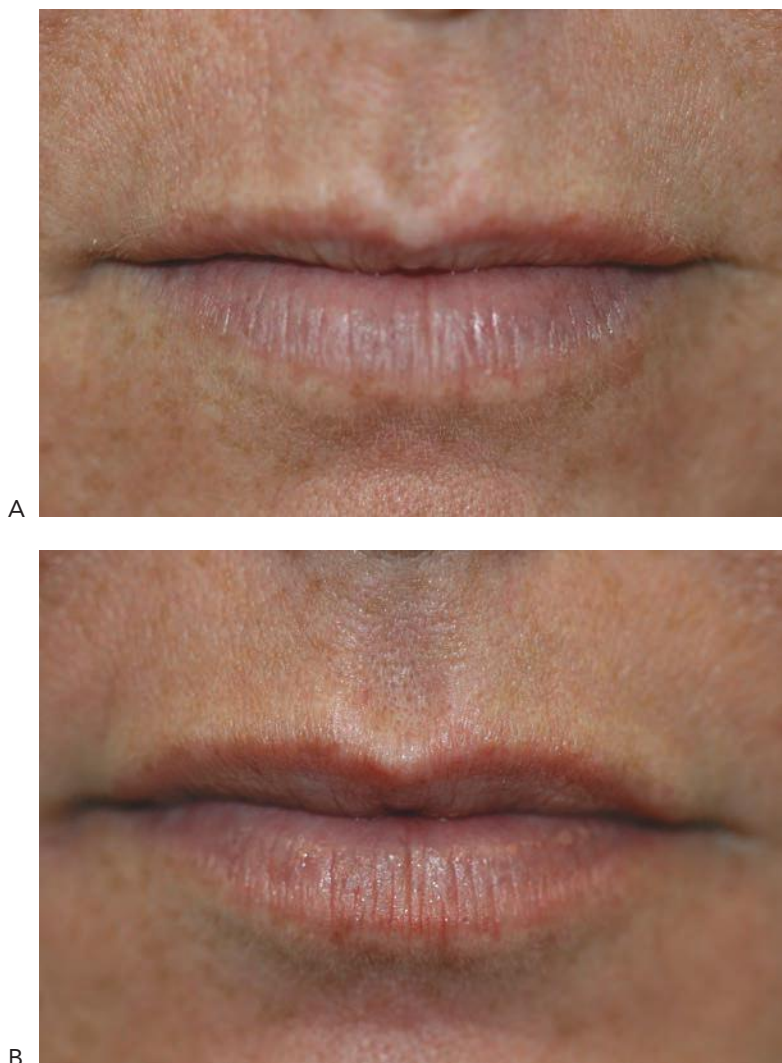


FIGURE 2 ● Upper lip fullness before **(A)** and 2 weeks after **(B)** botulinum toxin treatment of the upper orbicularis oris muscle, at rest. Copyright R. Small, MD.

- Apply a topical anesthetic such as benzocaine/lidocaine/tetracaine without occlusion, for 15 minutes before treatment.
- In addition, application of ice to patient tolerance, for up to 1–2 minutes, immediately before treatment is also recommended.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

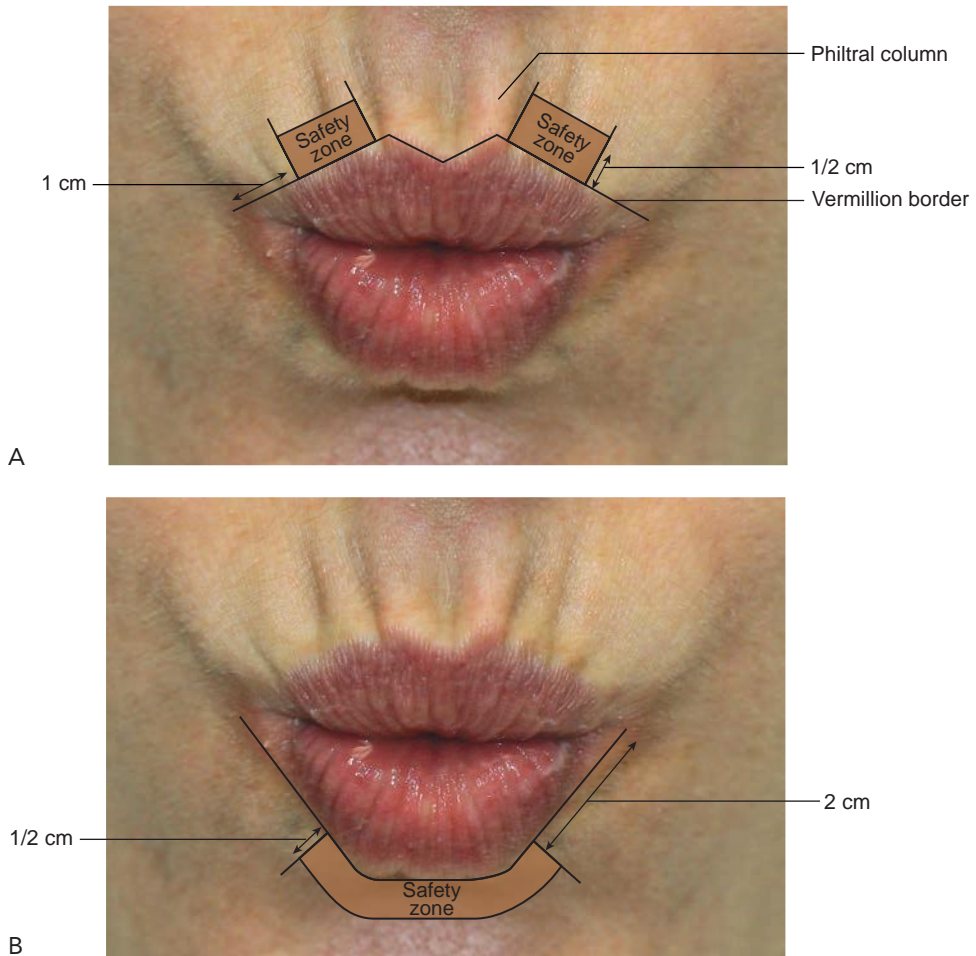
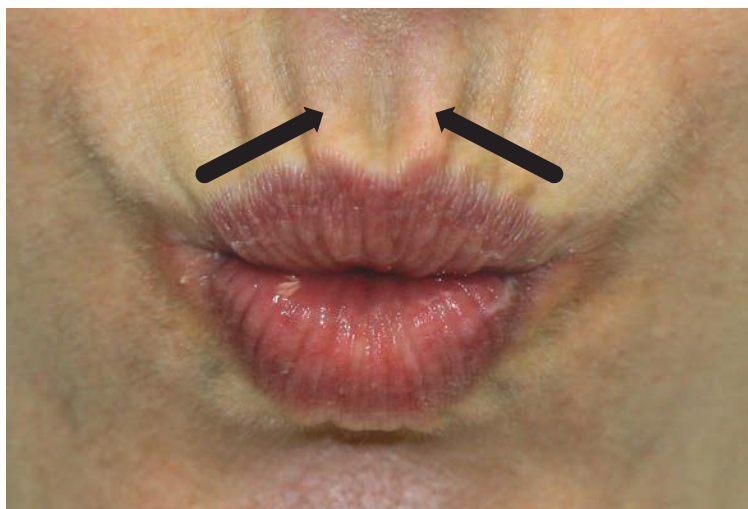


FIGURE 3 ● Lip line safety zones for the upper lip (A) and lower lip (B), with botulinum toxin treatments. Copyright R. Small, MD.

Procedure Overview

- Place injections in the lip line safety zone (Fig. 3).
 - **Upper lip safety zone** is at least 1 cm from the lateral corners of the mouth, 0.5 cm or less from the vermilion border, and extends to the lateral edge of the philtral column (Fig. 3A).
 - **Lower lip line safety zone** is at least 2 cm from the lateral corners of the mouth and is 0.5 cm or less from the vermilion border (Fig. 3B).
- An overview of injection points and OBTX doses for treatment of lip lines is shown in Figure 4. The upper lip requires one injection per side (Fig. 4A). The lower lip typically requires three injections, two laterally and one in the midline (Fig. 4B).



A ➤ = 2.5 units Botox, insert needle in direction of arrow



B ○ = 1.25 units Botox

FIGURE 4 ● Overview of botulinum toxin injection points and doses in the upper (A) and lower (B) lips for treatment of lip lines. Copyright R. Small, MD.

- Marking injection points with the muscle contracted before anesthesia is helpful because once anesthetized, patients are unable to contract this muscle.
- Botulinum toxin is injected subdermally using a threading technique for treatment of upper lip lines. Superficial injection is important to avoid the deeper muscles, which insert in the lip area and affect lip function.
- Injecting too deep or lateral to the lip line safety zone may involve muscles that control lip function and increase the risk of oral incompetence.
- Injecting medial to the lip line safety zone, into the philtral columns, may result in an undesired flattening of the Cupid's bow.

- Take care to inject equal doses bilaterally to avoid lip asymmetry.
- In patients who have never had botulinum toxin treatment of the lips, and for providers who are getting started with lip line botulinum toxin treatments, it is advisable to treat only the upper or the lower lip in a given visit.

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the lip line safety zone (Fig. 3).
3. Locate the orbicularis oris muscle by instructing the patient to contract the muscle using one of the facial expressions above.
4. Identify the injection points (Fig. 4). With the orbicularis oris muscle contracted, mark the two injection points on the upper lip in the ridges of the muscle, near the vermilion border, at least 1 cm from the corners of the mouth.
5. Apply topical anesthetic to the treatment area for 10–15 minutes and remove before treatment.
6. Apply ice for anesthesia to the side of the upper lip to be treated.
7. Prepare injection sites with alcohol and allow to dry.
8. The provider is positioned on the side that is to be injected.
9. While the mouth is at rest, insert the needle into the first injection point and thread superficially, such that the needle tip ends at the lateral edge of the philtral column. Use the first finger of the noninjecting hand to gently palpate the needle tip in the tissue and confirm placement. Inject 2.5 units with gentle, even plunger pressure as the needle is withdrawn (Fig. 5).
10. Compress the injection sites firmly to relieve discomfort.

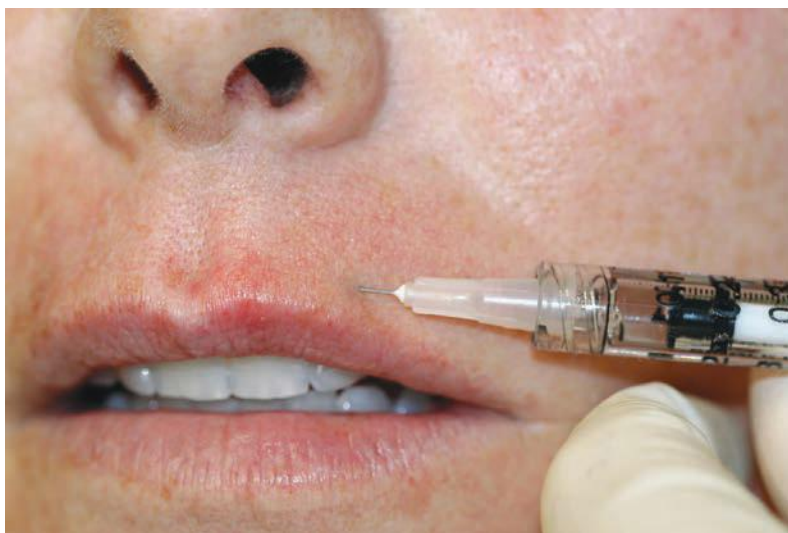


FIGURE 5 ● Orbicularis oris muscle botulinum toxin injection technique.
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11. Apply ice for anesthesia to the contralateral side of the upper lip to be treated.
12. Prepare injection sites with alcohol and allow to dry.
13. Repeat the above technique for the contralateral side of the upper lip.

Results

- **Reduction of dynamic lip lines** is typically seen 2 weeks after botulinum toxin treatment (see Figs. 1A and 1B).
- **Lip eversion with enhanced lip fullness** is also evident 2 weeks after botulinum toxin treatment (see Figs. 2A and 2B).
- **Preservation of the philtral columns and Cupid's bow**, with **minimal functional impairment of the mouth**, such that routine functions of eating, drinking, and speaking remain unaffected, are also desirable outcomes. Difficulty with puckering tightly, whistling, blowing a wind instrument, and sipping from a straw are anticipated and indicate that an adequate dose has been used.

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns by about 2 months after botulinum toxin treatment.
- Subsequent lip line treatments with botulinum toxin may be performed when function of the orbicularis oris muscle is regained and muscle ridges are visible.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of dynamic lip lines, lip eversion and preservation of oral function. Below are some commonly encountered follow-up issues:

- **Mild oral functional impairment.** Patients may complain of difficulty enunciating the letters “p” and “b,” swishing and spitting after brushing teeth, or difficulty sipping from a spoon. These effects typically resolve spontaneously by 2 weeks. If they are bothersome to the patient or are prolonged for more than 2 weeks, decrease the OBTX dose in the upper lip to 1 unit per side at subsequent treatments.
- **Persistent lip lines.** If lip lines are present, evaluate for the following common causes:
 - **Orbicularis oris muscle contraction.** Patients may have greater muscle mass than anticipated in the treatment area and additional botulinum toxin may be required to achieve desired results. Excessive orbicularis oris muscle function can be reduced with a touch-up procedure using 1.25 units of OBTX per side, depending on the degree of muscle activity present. Botulinum toxin is injected in the areas with excessive contractility demonstrating muscle ridges. Reassess patients 2 weeks after the touch-up. The efficacious dose of botulinum toxin for treatment of the upper lip is determined to be the initial dose plus the touch-up dose. Start with this total dose at the patient's subsequent upper lip treatment in approximately 2–3 months.

- **Static lines.** If static lines are present, patients may require several consecutive botulinum toxin treatments for improvements to be seen. Combining botulinum toxin with other minimally invasive aesthetic procedures can offer enhanced results for treatment of static lip lines (see Combining Aesthetic Treatments below).

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts section, Complications)
- Lip asymmetry
- Alteration of lip shape (static or dynamic)
- Oral incompetence with resultant drooling, impaired speaking, eating, or drinking

Lip asymmetry can result from unequal injection of botulinum toxin in the treatment area. This is rare and can be corrected by injecting small amounts of botulinum toxin into areas with excessive muscle contraction. The dose used will depend on the degree of muscle activity present, but typically 1.25 units of OBTX are placed in the areas of excessive contractility.

Alteration of lip shape, particularly flattening of the Cupid's bow, can result from medial injection of botulinum toxin in the philtral columns. Lip shape will be restored as botulinum toxin effects diminish.

Oral incompetence is a severe and rare complication, which can result in drooling, impaired speaking, eating, or drinking. Injecting too deeply or too laterally may involve the muscles that are important for oral competence. There is no corrective treatment for this complication and lip function will be regained as botulinum toxin effects diminish.

Botulinum Toxin Treatments in Multiple Areas

- **Upper and lower lips.** When getting started with botulinum toxin treatment of the lips, it is advisable to take a conservative approach and treat only the upper or the lower lip at the initial visit. Upper lip lines are a more common complaint than lower lip lines, and therefore, botulinum toxin treatment of the lips usually starts with the upper lip. After patients have successfully received at least one treatment of the upper lip with an efficacious botulinum toxin dose that achieves a favorable aesthetic effect with minimal to no compromise of oral functioning, patients may then receive treatment of the lower lip concomitantly with treatment of the upper lip.
- **Lower face.** The lower face is a highly functional region, responsible for speaking, eating, and drinking. It is therefore advisable to use a conservative approach to treatment in this region by rotating treatment areas, such that only one area is treated with botulinum toxin at any give time (see Introduction and Foundation Concepts section, Botulinum Toxin Treatments in Multiple Facial Areas).

Combining Aesthetic Treatments and Maximizing Results

- **Static lip lines.** Static lip lines respond well to a combination of botulinum toxin and dermal fillers and skin resurfacing procedures such as fractional ablative lasers.

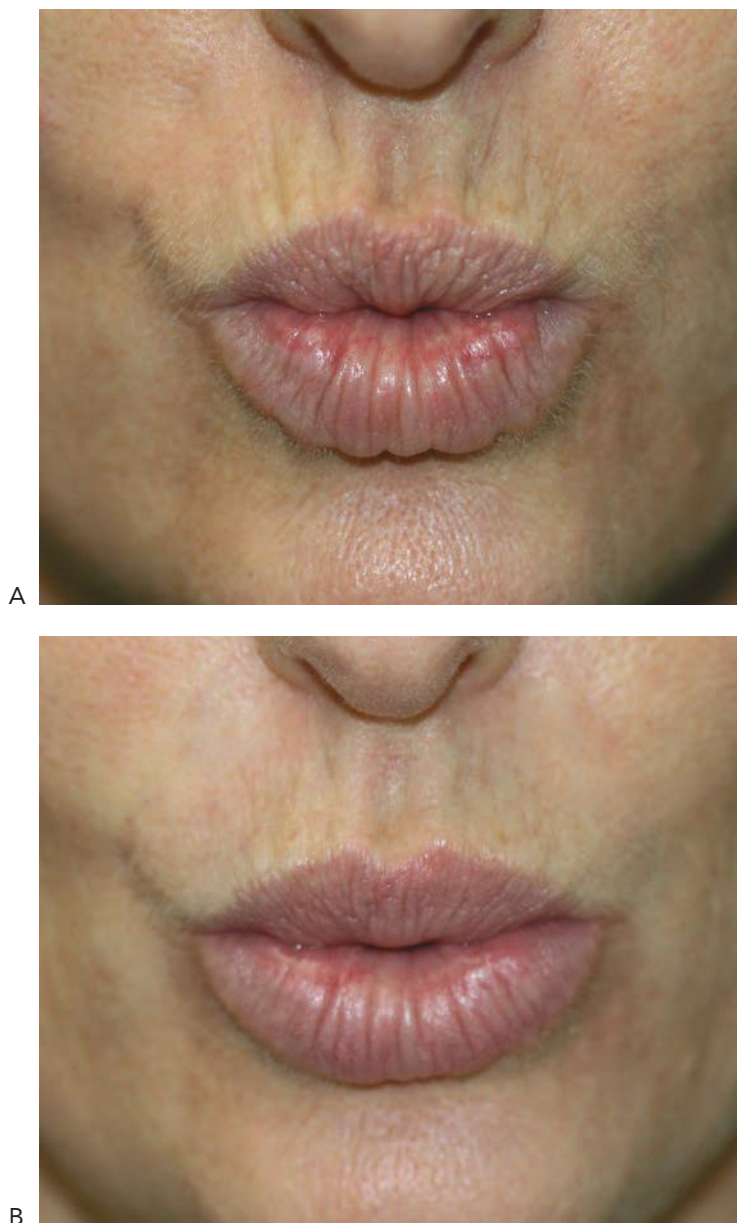


FIGURE 6 ● Upper lip lines before (A) and 1 month after (B) combination treatment with botulinum toxin and dermal filler above the upper lip, with active muscle contraction. Copyright R. Small, MD.

Figure 6 shows a patient before (Fig. 6A) and after (Fig. 6B) receiving a combination of botulinum toxin (Botox) and dermal filler (Radiesse® manufactured by Merz Aesthetics, Inc, San Mateo, CA) above the upper lip. Figure 7 shows a patient with more severe radial lip lines before (Fig. 7A) and after (Fig. 7B) receiving a combination of botulinum toxin (Botox), dermal filler (Radiesse), and fractional ablative skin resurfacing with an erbium laser (DermaSculpt manufactured by HOYA ConBio, Fremont, CA) above the upper lip.

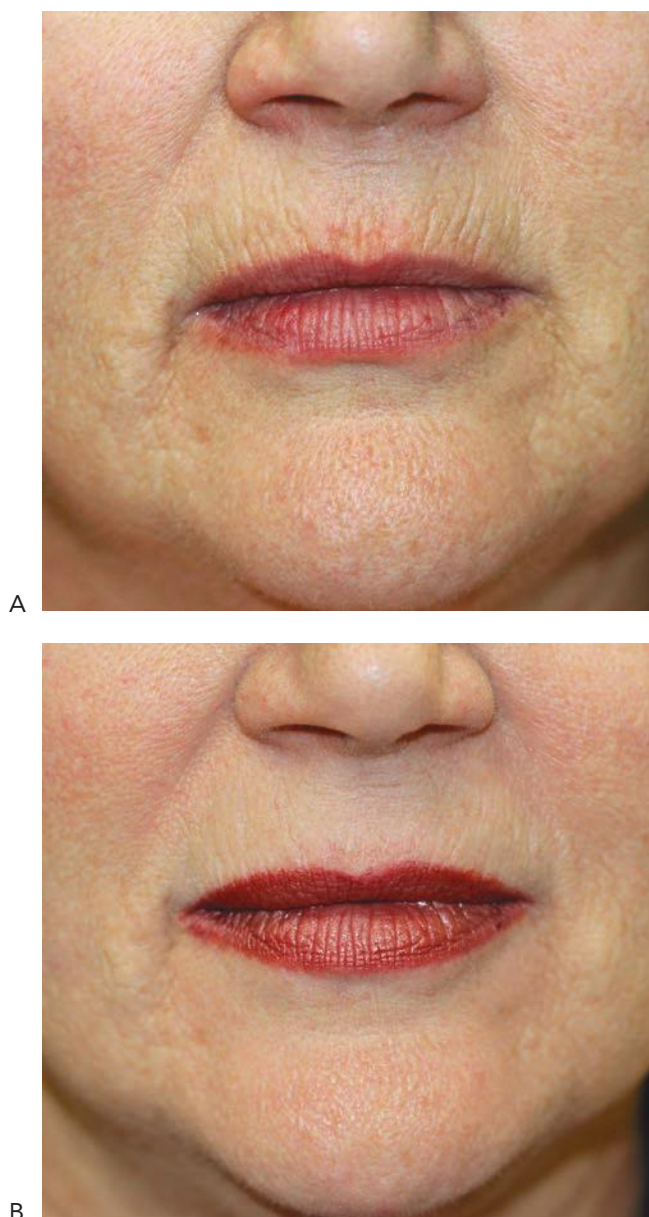


FIGURE 7 ● Upper lip lines before (A) and 1 month after (B) combination treatment with botulinum toxin, dermal filler, and fractional ablative laser resurfacing above the upper lip. Copyright R. Small, MD.

Pricing

Charges for botulinum toxin treatment of the upper lip or the lower lip range from \$125–\$200 per treatment or \$25–\$40 per unit of OBTX. This is an advanced treatment area and the unit price is greater than that for the basic areas of the upper face.

Gummy Smile



FIGURE 1 ● Gummy smile before (A) and 2 weeks after (B) botulinum toxin treatment of the levator labii superioris alaeque nasi muscle, while smiling. Copyright R. Small, MD.

Exaggerated upper lip retraction during smiling can result in a gummy smile with excessive gingival show. Gummy smiles associated with deep nasolabial folds result from contraction of the levator labii superioris alaeque nasi muscle. Treatment of the levator labii superioris alaeque nasi with botulinum toxin inhibits muscle contraction, which lengthens the upper lip reducing gingival show, and also reduces nasolabial folds.

Indications

- Gummy smile
- Nasolabial folds

Anatomy

- **Aesthetic norms.** A **gummy smile** reveals excessive gingiva, typically more than 2 mm above the central incisors, and is associated with inversion and thinning of the upper lip. The aesthetic norm for smiling is an upper lip covering the upper third of the central incisors during smiling.
- **Muscles targeted.** A gummy smile associated with a deep nasolabial fold results from contraction of the levator labii superioris alaeque nasi muscle (see Anatomy section,

Figs. 1 and 2) and is amenable to treatment with botulinum toxin as outlined in this chapter.

- **Muscle functions.** The levator labii superioris alaeque nasi muscle engages with smiling to function as a medial lip levator and contributes to formation of nasolabial folds (see Anatomy section, Fig. 7 and Table 1).
- **Muscles avoided.** A gummy smile associated with a flat nasolabial fold usually results from contraction of the levator labii superioris muscle, which is not amenable to botulinum toxin treatment. Other levator muscles that contribute to smile formation such as the levator anguli oris, zygomaticus major, and zygomaticus minor are also avoided with botulinum toxin treatment for a gummy smile (see Anatomy section, Fig. 3).

Patient Assessment

- **Social history** is obtained, including occupations/activities necessitating full oral competence, such as wind instrument musicians, actors, singers, and public speakers.
- **Gingival show with smiling** is assessed as follows:
 - **Gummy smiles associated with deep nasolabial folds** are amenable to botulinum toxin treatment using the technique outlined in this chapter.
 - **Gummy smiles and flat nasolabial folds** are not amenable to treatment with botulinum toxin.
- **Smile asymmetry** is assessed, and if present, pointed out to the patient before treatment.
- **Static lip structure** is assessed. The best candidates for treatment of a gummy smile often have upper lip retraction in which their upper incisors are visible at rest. The risk of excessive lip lengthening in these patients is minimal.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform the following expression:

- “Smile as hard as you can”

Treatment Goal

- Partial inhibition of the inferior labii superioris alaeque nasi muscle.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts section, Reconstitution Method).
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women and men: total (bilateral) dose is 2.5 units of OBTX.

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

Procedure Overview

- An overview of injection points and OBTX doses for treatment of a gummy smile is shown in Figure 2.
- Treatment of a gummy smile requires precise injection into the levator labii superioris alaeque nasi muscle and the outcome is highly dependent on the botulinum toxin dose and injection location.
- Botulinum toxin is injected intramuscularly for treatment of a gummy smile and the levator labii superioris alaeque nasi must be clearly visible for treatment to be performed.
- Injecting laterally may involve other lip levator muscles and increase the risk of smile asymmetry and oral incompetence.

Technique

1. Position the patient at a 60-degree reclined position.
2. Locate the levator labii superioris alaeque nasi muscle by instructing the patient to contract the muscle using the facial expression above.
3. Identify the injection points (Fig. 2).
4. Ice for anesthesia (optional).
5. Prepare injection sites with alcohol and allow them to dry.



○ = 1.25 units Botox

FIGURE 2 ● Overview of botulinum toxin injection points and doses for treatment of a gummy smile. Copyright R. Small, MD.



FIGURE 3 ● Levator labii superioris alaeque nasi muscle botulinum toxin injection technique. Copyright R. Small, MD.

6. The provider is positioned on the same side that is to be injected.
7. While the levator labii superioris alaeque nasi muscle is contracted, insert the needle in the muscle bulge at the uppermost part of the nasolabial fold (Fig. 3). The needle is angled medially and inserted to half the needle length. Inject 1.25 units of OBTX.
8. Compress the injection sites medially.
9. Repeat for the contralateral side of the face.

Results

- **Lengthening of the upper lip with reduction of gummy smile, and reduction of nasolabial folds** are evident 2 weeks after botulinum toxin treatment. Figure 1 shows a gummy smile and deep nasolabial fold with contraction of the levator labii superioris alaeque nasi muscle before (Fig. 1A) and 2 weeks after (Fig. 1B) botulinum toxin injection. Note that before treatment, the upper lip appears inverted and thinned whereas after treatment, lip fullness is enhanced.
- **Minimal or no functional impairment of the mouth** such that routine functions of eating, drinking, and speaking are unaffected, is also a desirable outcome.

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns by about 2 months after botulinum toxin injection.
- Subsequent treatments with botulinum toxin may be performed when function of the levator labii superioris alaeque nasi muscle is regained.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of a gummy smile with lengthening of the upper lip, reduction of nasolabial folds, oral function, and asymmetries. Some commonly encountered follow-up issues are as follows:

- **Persistent gummy smile.** It is desirable for patients to retain some levator labii superioris alaeque nasi muscle function, visible as elevation of the upper lip with

smiling. However, if the treated labii superioris alaeque nasi muscle has excessive muscle strength after treatment and gingival show is not reduced relative to the pre-treatment appearance, additional botulinum toxin may be required to achieve desired results. A touch-up procedure may be performed with 1.25 units of OBTX using the same method described above. Reassess 2 weeks after the touch-up. The dose of botulinum toxin for treatment of the labii superioris alaeque nasi muscle is determined to be the initial dose plus the touch-up dose. Start with this total dose at the patient's subsequent gummy smile treatment in approximately 2 months.

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts section, Complications)
- Smile asymmetry
- Lip ptosis
- Other lip asymmetry or alteration of lip shape (static or dynamic)
- Oral incompetence with resultant drooling or impaired elocution, eating, or drinking

Complications can occur frequently with treatment of gummy smiles. Patients often have **asymmetric smiles** at baseline, which they may not be aware of. A subtle pretreatment lip asymmetry may become exaggerated after symmetric botulinum toxin treatment of the levator labii superioris alaeque nasi muscle. Lip asymmetry may also result from unequal botulinum toxin doses administered to the levator labii superioris alaeque nasi muscle. In either case, a smile asymmetry may be corrected with a touch-up procedure (as outlined above), with injection on the side that has greater muscle contractility.

Lip ptosis may result from complete relaxation of the levator labii superioris alaeque nasi muscle with excessive dosing of botulinum toxin. Lateral injection or diffusion of botulinum toxin into other lip levator muscles (levator labii superioris, levator anguli oris, zygomaticus major, and zygomaticus minor) can also result in lip ptosis and/or **impair oral competence** resulting in drooling, or impaired elocution, eating, or drinking. There is no corrective treatment for these complications and they improve spontaneously as botulinum toxin effects wear off over 2 months.

Botulinum Toxin Treatments in Multiple Lower Face Areas

The lower face is a highly functional region, responsible for speaking, eating, and drinking. It is, therefore, advisable to use a conservative approach to treatment in this region by rotating treatment areas, such that only one area is treated with botulinum toxin at any give time (see Introduction and Foundation Concepts section, Botulinum Toxin Treatments in Multiple Facial Areas).

Combining Aesthetic Treatments and Maximizing Results

- **Upper lip enhancement.** Patients who present with a gummy smile and deep nasolabial folds often have a thin upper lip as well. These patients can often benefit from combining botulinum toxin treatment of the levator labii superioris alaeque nasi muscle

with dermal filler in the body of the lips. Dermal filler alone often yields suboptimal results in these patients.

- **Nasolabial folds.** Nasolabial folds respond well to dermal filler treatment alone and rarely require combination treatment with botulinum toxin in the levator labii superioris alaeque nasi muscle.

Pricing

Charges for botulinum toxin treatment of a gummy smile range from \$125–\$200 per treatment or \$25–\$40 per unit of OBTX. This is an advanced treatment area and the price per unit is greater than that for the basic areas of the upper face.

Marionette Lines

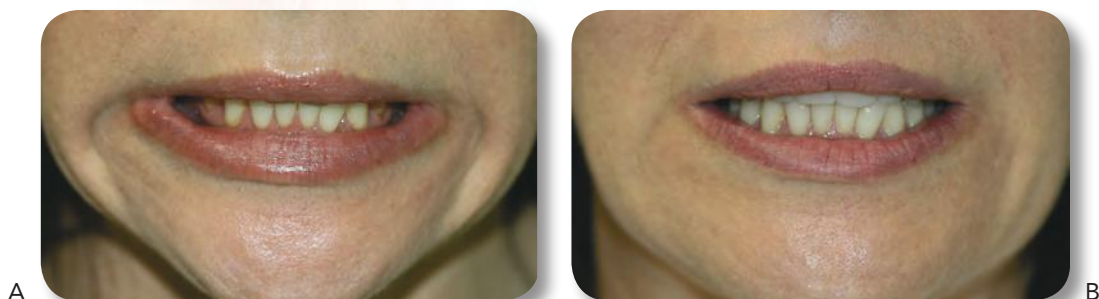


FIGURE 1 ● Marionette lines before **(A)** and 2 weeks after **(B)** botulinum toxin treatment of the depressor anguli oris muscle, with active muscle contraction. Copyright R. Small, MD.

Marionette lines and down-turned corners of the mouth result from contraction of the depressor anguli oris muscle as well as the loss of perioral soft-tissue density. These lines can give the face a sad or sullen expression. Treatment of the depressor anguli oris with botulinum toxin inhibits muscle contraction, resulting in elevation of the corners of the mouth and reduction of marionette lines.

Indications

- Marionette lines
- Elevation of down-turned corners of the mouth
- Enhanced smile

Anatomy

- **Wrinkles.** Marionette lines, or melomental folds, extend inferiorly from the oral commissures toward the jaw line (see Anatomy section, Figs. 4 and 5). The oral commissure is the junction between the upper and lower lip at the corner of the mouth.

- **Muscles targeted.** Botulinum toxin treatment of marionette lines targets the depressor anguli oris muscle. This triangular shaped muscle originates on the mandibular border and inserts on the corner of the mouth. The superior platysma muscle interdigitates with the depressor anguli oris near the mandible and can also contribute to marionette line formation (see Anatomy section, Figs. 1 and 2).
- **Muscle functions.** The depressor anguli oris muscle is activated with frowning and functions to draw the corners of the mouth inferiorly (see Anatomy section, Fig. 7 and Table 1). It antagonizes the levator muscles of the corners of the mouth (levator anguli oris, zygomaticus major, and zygomaticus minor), which are activated with smiling. Adequate strength of the depressor anguli oris is required for moving food intraorally with mastication and also functions to limit elevation of the corners of the mouth with smiling.
- **Muscles avoided.** The depressor labii inferioris muscle, a central lip depressor, lies medial to the depressor anguli oris muscle and is avoided with treatment of marionette lines. The buccinator muscle, involved in flattening the cheek, lies lateral to the depressor anguli oris and is also avoided (see Anatomy section, Fig. 3).

Patient Assessment

- **Social history** is obtained, including occupations/activities necessitating full oral competence such as wind instrument musicians, actors, singers, and public speakers.
- **Dynamic** (with muscle contraction) and **static** (at rest) **marionette lines** and **down-turned corners of the mouth** are assessed.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform any of the following expressions:

- “Clench your teeth and pull the corners of your mouth downward”
- “Show me your bottom teeth”
- “Grimace”
- Say “ew” or “eek”

Treatment Goal

- Partial inhibition of the depressor anguli oris muscle.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved saline (see Introduction and Foundation Concepts section, Reconstitution Method).
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women and men: total (bilateral) dose is 5 units of OBTX.

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

Procedure Overview

- Place injections within the marionette line safety zone (Fig. 2). The safety zone is at least 1 cm anterior to the border of the masseter muscle, posterior to the marionette line, and within 2 cm of the mandibular margin. The anterior margin of the masseter muscle can be identified by palpating the middle of the mandible and directing the patient to contract the masseter muscle by clenching their teeth. The marionette line is a perpendicular line drawn from the corner of the mouth to the jaw at rest.



FIGURE 2 ● Marionette line safety zone for botulinum toxin treatments. Copyright R. Small, MD.

- An overview of injection points and OBTX doses for treatment of marionette lines is shown in Figure 4, from the front (Fig. 4A) and oblique (Fig. 4B) views. Treatment of marionette lines requires only one injection per side.
- Precise injection at the depressor anguli oris muscle is achieved through visualization and direct palpation of the contracted muscle. If the depressor anguli oris muscle cannot be identified, treatment of marionette lines with botulinum toxin should not be performed.
- Botulinum toxin is injected intramuscularly for treatment of marionette lines.
- Injecting inferior to the marionette line safety zone may involve muscles that control the central lower lip, such as the depressor labii inferioris, increasing the risk of lip asymmetry.
- Injecting lateral to the marionette line safety zone may involve the cheek buccinator muscle, increasing the risk of cheek flaccidity.
- Injecting too close to the lip outside of the marionette line safety zone may involve the orbicularis oris, increasing the risk of oral incompetence.

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the marionette line safety zone (Fig. 2).
3. Locate the inferior portion of the depressor anguli oris muscle that lies within the safety zone by instructing the patient to contract the muscle, using one of the facial expressions above, and palpate the muscle (Fig. 3).
4. Identify the injection points. The needle insertion point is at the intersection of the lateral canthal line and the nasolabial fold line (Figs. 4A and 4B).



FIGURE 3 ● Depressor anguli oris muscle palpation. Copyright R. Small, MD.

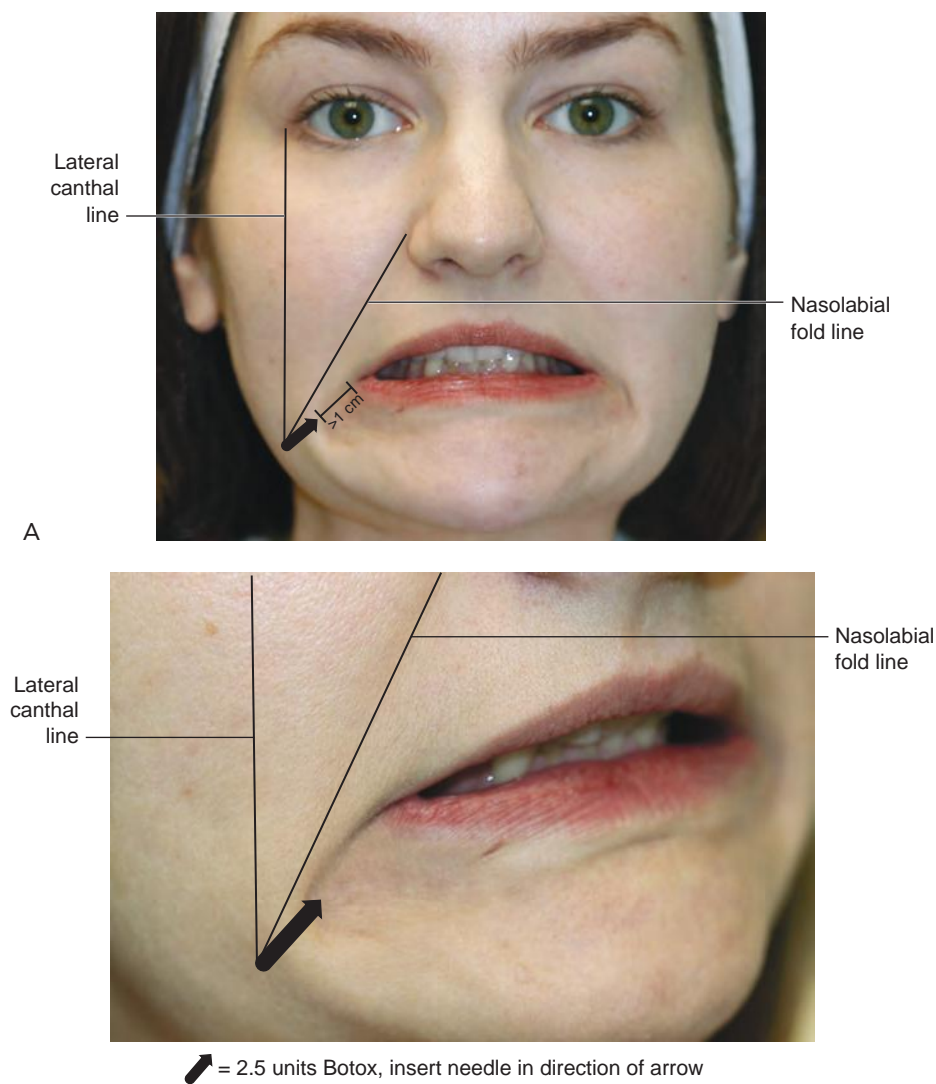


FIGURE 4 ● Overview of botulinum toxin injection points and doses for treatment of marionette lines: (A) front and (B) oblique view. Copyright R. Small, MD.

5. Ice for anesthesia (optional).
6. Prepare injection sites with alcohol and allow to dry.
7. The provider is positioned on the same side that is to be injected.
8. While the depressor anguli oris muscle is contracted, insert the needle in the depressor anguli oris muscle, at least 1 cm inferior to the corner of the lip. Angle the needle towards the corner of the mouth with the tip at the depressor anguli muscle. Inject 2.5 units of OBTX (Fig. 5).
9. Compress the injection sites firmly in an inferior direction.
10. Repeat this injection technique for the contralateral side of the face.



FIGURE 5 ● Depressor anguli oris muscle botulinum toxin injection technique. Copyright R. Small, MD.

Results

- **Reduction of dynamic marionette lines, depressor anguli oris muscle strength and elevation of the corners of the mouth** are evident 2 weeks after botulinum toxin treatment. Figure 1 shows contraction of the depressor anguli oris muscle before (Fig. 1A) and 2 weeks after (Fig. 1B) botulinum toxin injection. Botulinum toxin treatment results in the lower face are subtle, relative to the dramatic changes seen in the upper third of the face. Patients may appreciate pre- and posttreatment dynamic improvements if they are schooled in how to make these assessments with animation. However, they may not be able to appreciate a difference when the face is static.
- **Minimal or no functional impairment of the mouth**, such that routine functions of eating, drinking, and speaking are unaffected, is also a desirable outcome.

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns by about 2–3 months after botulinum toxin injection.
- Subsequent treatments with botulinum toxin may be performed when function of the depressor anguli oris muscle is regained.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for weakening of the depressor anguli oris muscle, reduction of marionette lines, elevation of the corners of the mouth and retention of oral function. Some commonly encountered follow-up issues are as follows:

- **Persistent depressor anguli oris muscle strength.** Patients may retain depressor anguli oris strength if they have greater muscle mass than anticipated or with improper placement of botulinum toxin at the time of treatment. Excessive depressor anguli oris strength can be reduced with a touch-up procedure using 1.25–2.5 units of OBTX per side, depending on the degree of muscle activity present. Reassess 2 weeks after the touch-up. The efficacious dose of botulinum toxin for treatment of the depressor anguli oris muscle is determined to be the initial dose plus the touch-up dose. Start with this total dose at the patient's subsequent marionette lines treatment in approximately 2–3 months.
- **Persistent marionette lines.** Static marionette lines with down-turned corners of the mouth typically require combination treatment with dermal fillers to achieve dramatic improvements (see Combining Aesthetic Treatments given later).
- **Mild oral functional impairment.** Difficulty with swishing liquids (e.g., after brushing teeth) and mild food trapping in the lower gingivobuccal groove are anticipated, which indicate that an adequate dose has been used. These effects typically resolve spontaneously by 2–4 weeks.

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts section, Complications).
- Lip asymmetry or alteration of lip shape (static or dynamic).
- Cheek flaccidity.
- Oral incompetence with resultant drooling or impaired elocution, eating, or drinking.

Lip asymmetry can result from unequal injection of botulinum toxin in the depressor anguli oris muscles. Lowering of the corner of the mouth with depressor anguli oris muscle contraction is evident on the untreated side (Fig. 6) because of retained depressor function of the depressor anguli oris. This can be corrected by injection of small botulinum toxin doses in the untreated side, as described earlier, for treatment of persistent depressor anguli oris muscle strength.

Lip asymmetry may also result from medial injection or diffusion of botulinum toxin into the depressor labii inferioris muscle. The depressor labii inferioris functions to lower the central lip, and relaxation of this muscle with botulinum toxin, therefore, results in elevation of the lip (see Chin chapter, Fig. 6), which is most noticeable with smiling. This effect typically resolves spontaneously over 2–4 weeks. It may be corrected with injection of 1.25 units of OBTX in the unaffected depressor labii inferioris muscle. However, watchful waiting for botulinum toxin effects to spontaneously resolve is recommended for management if lip asymmetry due to depressor labii inferioris muscle involvement is not too significant.

Cheek flaccidity may result from lateral injection or diffusion of botulinum toxin into the buccinator muscle. Patients may experience difficulty with mastication and be predisposed to biting the cheek.



➤ = 2.5 units Botox, insert needle in direction of arrow

FIGURE 6 ● Asymmetric depressor anguli oris muscle strength with increased contraction on the right side and correction with botulinum toxin. Copyright R. Small, MD.

Oral incompetence is a severe and rare complication that can result in drooling or impaired elocution, eating, or drinking. Injecting too close to the lip may involve the orbicularis oris muscle, which is important for oral competence. There is no corrective treatment for this complication and it improves spontaneously as the botulinum toxin effect wears off over 2–3 months.

Botulinum Toxin Treatments in Multiple Lower Face Areas

- The lower face is a highly functional region, responsible for speaking, eating, and drinking. It is, therefore, advisable to use a conservative approach to treatment in this region by rotating treatment areas, such that only one area is treated with botulinum toxin at any give time (see Introduction and Foundation Concepts section, Botulinum Toxin Treatments in Multiple Facial Areas).

Combining Aesthetic Treatments and Maximizing Results

- **Static marionette lines.** Static marionette lines and downturned oral commissures respond well to a combination of botulinum toxin and dermal fillers. Figure 7 shows a patient before (Fig. 7A) and after (Fig. 7B) receiving a combination of botulinum toxin (Botox) in the depressor anguli oris muscle and dermal filler (Juvederm; Allergan, Inc., Irvine, CA) in the marionette lines.

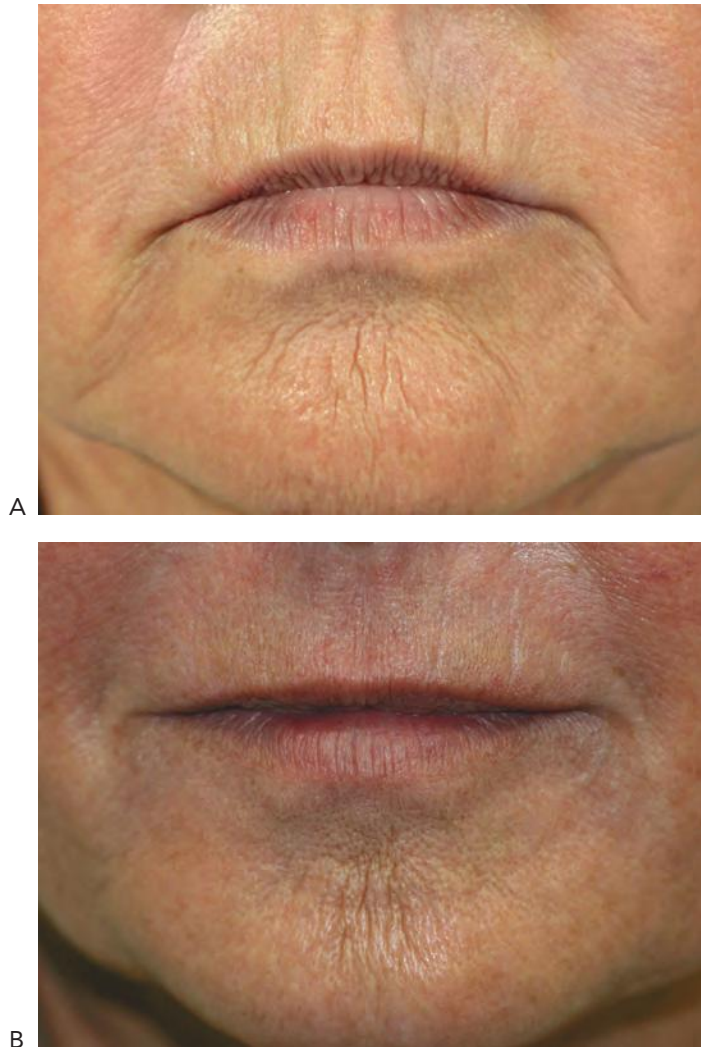


FIGURE 7 ● Marionette lines before **(A)** and after **(B)** combination treatment with botulinum toxin in the depressor anguli oris muscle and dermal filler in the marionette lines and oral commissures. Copyright R. Small, MD.

Pricing

Charges for botulinum toxin treatment of marionette lines range from \$125–\$200 per treatment or \$25–\$40 per unit of OBTX. This is an advanced treatment area and the price per unit is greater than that for the basic areas of the upper face.

Chin



FIGURE 1 ● Puckered chin before (A) and 2 weeks after (B) botulinum toxin treatment of the mentalis muscle, with active pouting. Copyright R. Small, MD.

A puckered or cobblestoned appearance to the chin, and formation of a dynamic mental crease, result from contraction of the mentalis muscle. Treatment of the mentalis muscle with botulinum toxin inhibits contraction, which smoothes the chin surface and reduces the mental crease.

Indications

- Puckered or cobblestoned chin
- Mental crease

Anatomy

- **Wrinkles.** The mental crease, or labiomental crease, is a horizontal line inferior to the lower lip (see Anatomy section, Figs. 4 and 5). The mentalis muscle has numerous



FIGURE 2 ● Pebbly chin before (A) and 2 weeks after (B) botulinum toxin treatment of the mentalis muscle, with active pouting. Copyright R. Small, MD.

attachments to the skin of the chin and contraction causes puckering and textural changes of the chin, referred to as a cobblestoned, pebbly, peach pit, dimpled, or *peau d'orange* appearance.

- **Muscles targeted.** Botulinum toxin chin treatment targets the mentalis muscle. This is a deep, two-bellied muscle. However, because of the superficial skin attachments, botulinum toxin is injected superficially (see Anatomy section, Figs. 1 and 2).
- **Muscle functions.** The mentalis muscle raises and protrudes the lower lip with pouting and drinking (see Anatomy section, Fig. 7 and Table 1).

- **Muscles avoided.** The depressor labii inferioris muscle, a central lip depressor, lies lateral to the mentalis muscle and is avoided with treatment of the chin. The orbicularis oris muscle lies superior to the mentalis muscle and is also avoided with treatment of the chin.

Patient Assessment

- **Social history** is obtained, including occupations/activities necessitating full oral competence, such as wind instrument musicians, actors, singers, and public speakers.
- **Dynamic puckering of the chin** and **mental crease formation** are assessed with contraction of the mentalis muscle. Patients are often unaware of chin puckering because it is most obvious during facial expressions when patients rarely observe themselves.
- **Static mental crease** is also assessed.

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform following expression:

- “Pout”

Treatment Goal

- Partial inhibition of the mentalis muscle.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved sterile saline (see Introduction and Foundation Concepts, Reconstitution Method).
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women and men: total dose is 5 units of OBTX.

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

Procedure Overview

- Place injections within the chin safety zone (Fig. 3). The circumference of the chin is determined at rest, with the highest point at the mental crease. The safety zone is at least 1 cm medial to the chin circumference and is within 2 cm of the mandibular margin.

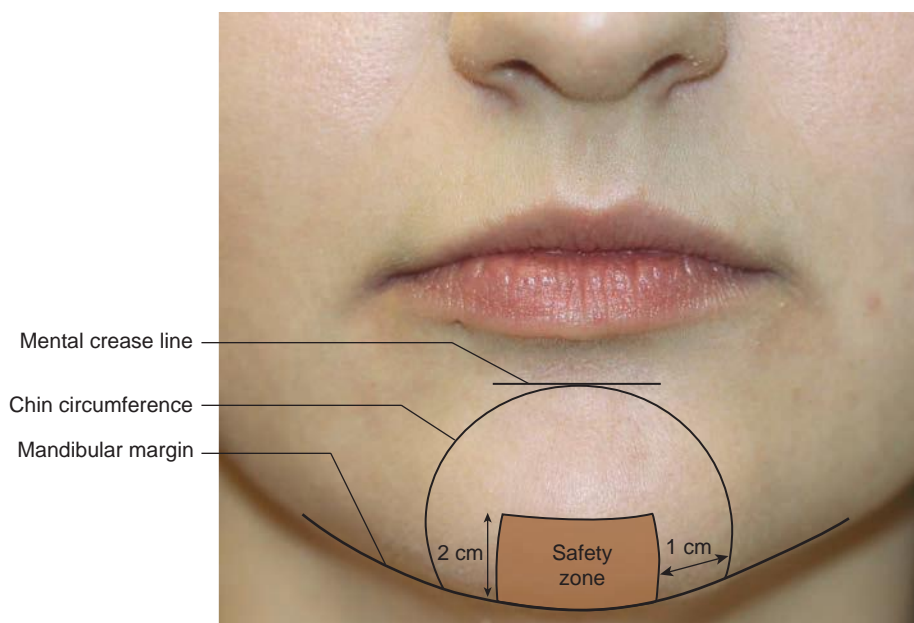

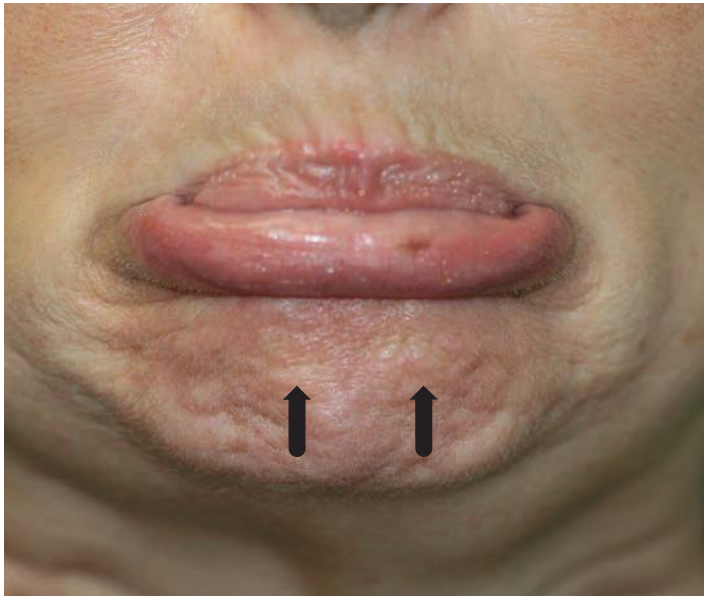


FIGURE 3 ● Chin safety zone for botulinum toxin treatments. Copyright R. Small, MD.

- Two techniques, based on the presenting chin shape, are commonly used for treating the chin. An overview of injection points and OBTX doses for these two methods is shown in Figure 4.
 - **Single injection technique**, with one medial injection point, is used for a narrow, rounded, or pointed chin (Fig. 4A).
 - **Double injection technique**, with one injection point on each side of the midline, is used for a broad, square, or cleft chin (Fig. 4B).
- Botulinum toxin is injected subdermally or superficial intramuscularly for treatment of chin puckering and the mental crease.
- Some patients engage several muscles, in addition to the mentalis muscle, with pouting, such as the depressor anguli oris and depressor labii inferioris, which can obscure the borders of the mentalis muscle and falsely give the appearance of a wide, square chin. If the mentalis muscle borders are indistinct, use the single injection technique to minimize the risk of injecting too laterally.
- Injecting lateral to the safety zone may involve the depressor labii inferioris muscle, resulting in lip asymmetry with elevation on the affected side.
- Injecting superior to the safety zone may involve the orbicularis oris muscle, resulting in functional impairment of the mouth.



A

 = 5 units Botox, insert needle in direction of arrow

B


 = 2.5 units Botox, insert needle in direction of arrow

FIGURE 4 ● Overview of botulinum toxin injection points and doses for treatment of the chin using single (**A**) and double (**B**) injection techniques. Copyright R. Small, MD.



FIGURE 5 ● Botulinum toxin treatment of the mentalis muscle using the single injection technique. Copyright R. Small, MD.

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the chin safety zone (Fig. 3).
3. Locate the mentalis muscle by instructing the patient to contract the muscle using the facial expression above.
4. Select the single or double injection technique on the basis of the shape of the chin. Identify the injection points (Fig. 4).
5. Ice for anesthesia (optional).
6. Prepare injection sites with alcohol and allow to dry.
7. The provider is positioned in front of the patient.
8. **Single injection technique.** While the mentalis muscle is contracted, insert the needle just superior to the mandibular margin within the safety zone in the midline. Angle the needle and thread towards the lip such that the needle tip ends at the chin protuberance, at least 2 cm inferior to the vermilion border (Fig. 5). Inject 5 units of OBTX as the needle is slowly withdrawn, using gentle even plunger pressure.
9. **Double injection technique.** While the mentalis muscle is contracted, insert the needle lateral to the midline, just superior to the mandibular margin within the safety zone. Angle the needle and thread toward the lip such that the needle tip ends at the chin protuberance, at least 2 cm inferior to the vermilion border. Inject 2.5 units of OBTX in each site as the needle is slowly withdrawn, using gentle even plunger pressure. Repeat the above injection for the opposite site of the chin, equidistant from the midline.
10. Compress the injection sites firmly in an inferior direction.

Results

- **Smoothing of the chin and reduction of a dynamic mental crease** are evident 2 weeks after botulinum toxin treatment. Figure 1 shows contraction of the mentalis muscle in a patient with a narrow, rounded chin before (Fig. 1A) and 2 weeks after (Fig. 1B) botulinum toxin injection using the single injection technique. Figure 2 shows contraction of the mentalis muscle in a patient with a broader, square

chin before (Fig. 2A) and 2 weeks after (Fig. 2B) botulinum toxin injection using the double injection technique. Note that this patient engages the depressor anguli oris muscle with pouting and, as anticipated, this muscle is still active after treatment of the mentalis muscle (Fig. 2B). Patients are able to appreciate pre- and posttreatment improvements when schooled in making dynamic assessments of the chin.

- **Minimal or no functional impairment of the mouth**, such that routine functions of eating, drinking, and speaking are unaffected, is also a desirable outcome.

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns by about 2–3 months after botulinum toxin injection.
- Subsequent treatments with botulinum toxin may be performed when function of the mentalis muscle is regained.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for weakening of the mentalis muscle and oral function. If persistent cobblestone or puckered appearance is present, evaluate for the following common causes:

- **Persistent chin puckering and/or dynamic mental crease.** It is desirable for patients to retain some mentalis muscle function, which may be visible as mild chin puckering or cobblestoning and mental crease formation. If significant puckering is present after treatment, with minimal chin smoothing relative to the pretreatment appearance, additional botulinum toxin may be required to achieve a desirable result. A touch-up procedure may be performed with 2.5 units or less of OBTX using the same method as described earlier. Reassess for aesthetic results and oral function 2 weeks after the touch-up. The efficacious dose of botulinum toxin for mentalis muscle treatment is determined to be the initial dose plus the touch-up dose. Start with this total dose at the patient's subsequent mentalis muscle treatment in approximately 2–3 months.
- **Static mental crease.** A static mental crease seen with the chin at rest, may improve with several consecutive botulinum toxin treatments. Combination treatment with dermal fillers is typically required to achieve a dramatic improvement.



FIGURE 6 ● Lip asymmetry with elevation of the right lower lip due to weakening of the right depressor labii inferioris muscle with botulinum toxin. Copyright R. Small, MD.

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts section, Complications).
- Lip asymmetry or alteration of lip shape (static or dynamic).
- Oral incompetence with resultant drooling and impaired elocution, eating, or drinking.

Lip asymmetry or alteration of lip shape may result from lateral injection or diffusion of botulinum toxin into the depressor labii inferioris muscle. The depressor labii inferioris muscle functions to lower the central lip and relaxation of this muscle with botulinum toxin, therefore, results in elevation of the lip. Figure 6 shows lip asymmetry with elevation of the right lower lip due to weakening of the right depressor labii inferioris muscle with botulinum toxin. This effect typically resolves spontaneously over 2–4 weeks. Lower lip symmetry may be restored with injection of 1.25 units of OBTX into the unaffected depressor labii inferioris muscle. However, watchful waiting for botulinum toxin effects to spontaneously resolve is recommended for management if the lip asymmetry is not too bothersome to the patient.

Oral incompetence is a severe and rare complication, which can result in drooling or impaired elocution, eating, or drinking. Injecting too close to the lip may involve the orbicularis oris muscle, which is important for oral competence. Full immobilization of the mentalis muscle with excessively high botulinum toxin doses may also result in oral incompetence from impaired ability to elevate the lower lip. There are no corrective treatments for these complications and they improve spontaneously as the botulinum toxin effect wears off over 2–3 months.

Botulinum Toxin Treatments in Multiple Lower Face Areas

- The lower face is a highly functional region, responsible for speaking, eating, and drinking. It is, therefore, advisable to use a conservative approach to treatment in this region by rotating treatment areas, such that only one area is treated with botulinum toxin at any given time (see Introduction and Foundation Concepts section, Botulinum Toxin Treatments in Multiple Facial Areas).

Combining Aesthetic Treatments and Maximizing Results

- **Static mental crease.** Static mental creases respond well to combination treatment of botulinum toxin injection in the mentalis muscle and dermal fillers in the mental crease.

Pricing

Charges for botulinum toxin treatment of the mental crease range from \$125–\$250 per treatment or \$25–\$50 per unit of OBTX. This is an advanced treatment area and the price per unit is greater than that for the basic areas of the upper face.

Neck Bands

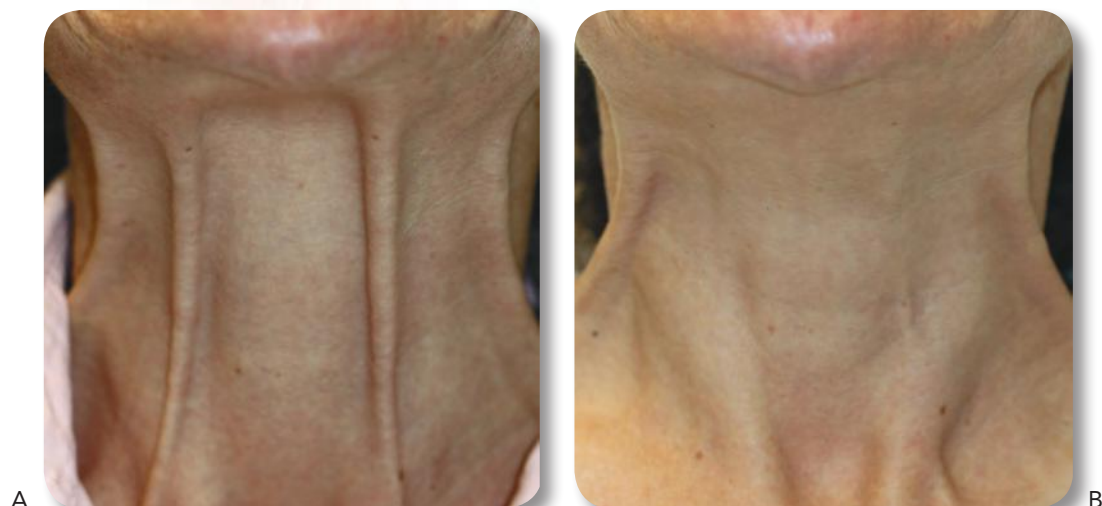


FIGURE 1 ● Neck bands before (A) and 2 weeks after (B) botulinum toxin treatment of the platysma muscle, with active muscle contraction. Copyright R. Small, MD.

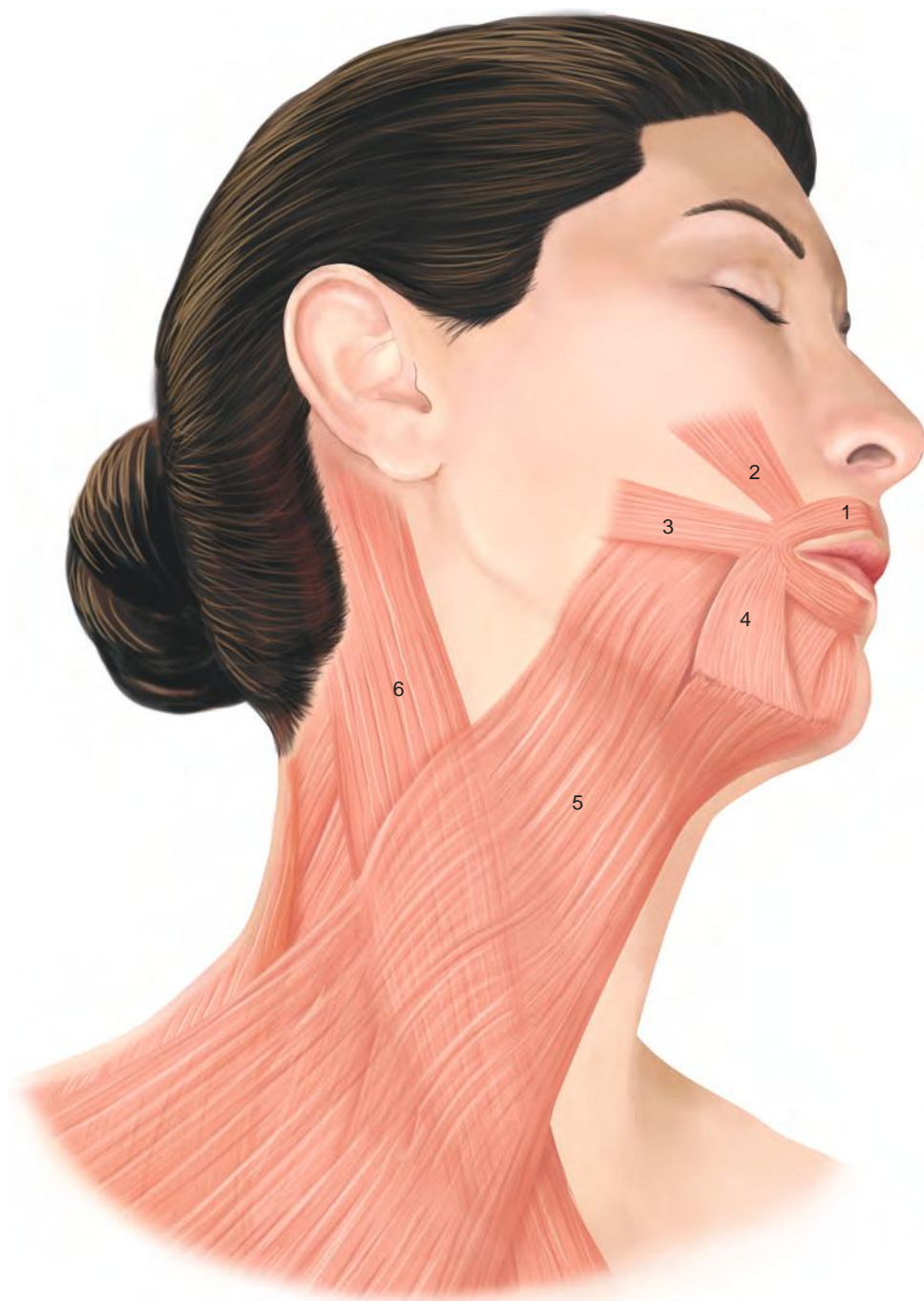
Vertical neck bands result from contraction of the platysma muscle. Treatment of the platysma muscle with botulinum toxin inhibits contraction, which reduces neck band formation and submental fullness, resulting in a more defined neck contour.

Indications

- Neck bands
- Reduction of submental fullness, also referred to as neck lifting

Anatomy

- **Neck bands.** Neck bands, or platysmal bands, are typically two or more vertical folds that extend from the margin of the mandible to the clavicles (Fig. 1A). They are most



- | | |
|-------------------------|-----------------------------|
| 1. Orbicularis oris m. | 4. Depressor anguli oris m. |
| 2. Zygomaticus major m. | 5. Platysma m. |
| 3. Risorius m. | 6. Sternocleidomastoid m. |

FIGURE 2 ● Neck and lower face muscles. Copyright R. Small, MD.

evident with straining, for example when lifting a heavy weight or when speaking animatedly. Increased resting tone in the platysma muscle with age also contributes to platysmal band formation.

- **Muscle targeted.** Botulinum toxin neck band treatment targets the anterior neck platysma muscle. The platysma is a broad muscle that covers the anterior and lateral neck and the lower face (Fig. 2). It originates at pectoralis and deltoid muscles, extends over the clavicle, and inserts into different regions of the lower face.
- **Muscle functions.** The platysma muscle depresses the jaw and the corners of the mouth, expands the diameter of the neck, and in some cases, depresses the cheek. The anterior lower face fibers, which insert on the mandible, function as jaw depressors. The posterior lower face fibers, which pass over the mandible and interdigitate with the inferior perioral muscles such as the depressor anguli oris muscle, draw the corners of the mouth, and in some cases, the cheek, downward and laterally. The neck fibers expand the diameter of the neck.
- **Muscles avoided.** The platysma muscle overlies deeper neck muscles, including the sternocleidomastoid and laryngeal muscles, and is separated from them by a thin fascial layer. These deeper neck muscles are avoided with botulinum toxin treatment of neck bands.

Patient Assessment

- **Neck aging changes** are assessed, including platysmal bands, wrinkles, skin laxity, and increased adiposity.
 - **Platysmal muscle bands** are identified with platysma contraction while the patient is straining. These bands are responsive to treatment with botulinum toxin.
 - **Skin laxity and adiposity** are visible at rest. They are not improved with botulinum toxin treatment, and skin laxity may actually worsen with treatment. Figure 3 shows a patient at rest with lax skin folds that lie in a similar position to folds seen with platysmal neck bands. Lax skin folds and submental adiposity are not an indication for botulinum toxin treatment.
 - **Wrinkles** on the neck usually appear as static horizontal “necklace” lines. Some evidence suggests that horizontal neck lines improve with botulinum toxin treatments of the platysma muscle using a different method from that used to treat neck bands (see Other Neck Botulinum Toxin Treatments below).

Eliciting Contraction of Muscles to Be Treated

Instruct the patient to perform any of the following expressions:

- “Strain as if lifting heavy dumbbells with your arms”
- “Clench your teeth and pull the corners of your mouth downward”
- Say “ew” or “eek”

Treatment Goal

- Complete inhibition of the anterior neck platysma muscle.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved sterile saline (see Introduction and Foundation Concepts section, Reconstitution Method).



FIGURE 3 ● Skin laxity seen from the front (**A**) and lateral (**B**) views is not an indication for botulinum toxin treatment of the neck. Copyright R. Small, MD.

- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women and men: 7.5–12.5 units of OBTX per neck band for a total of 15–25 units for two neck bands.

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

Procedure Overview

- Place injections within the neck band safety zone (Fig. 4). The safety zone is 1 cm lateral to the trachea and extends to the oral commissure lines, which are vertical lines extending inferiorly from the oral commissures to the clavicles. The safety zone is at least 2 cm inferior to the mandible and at least 4 cm superior to the clavicle margins.
- An overview of injection points and OBTX doses for treatment of neck bands is shown in Figure 5.
- Botulinum toxin is injected intramuscularly for treatment of neck bands. Intramuscular injection is achieved by grasping the neck band firmly between the first finger and

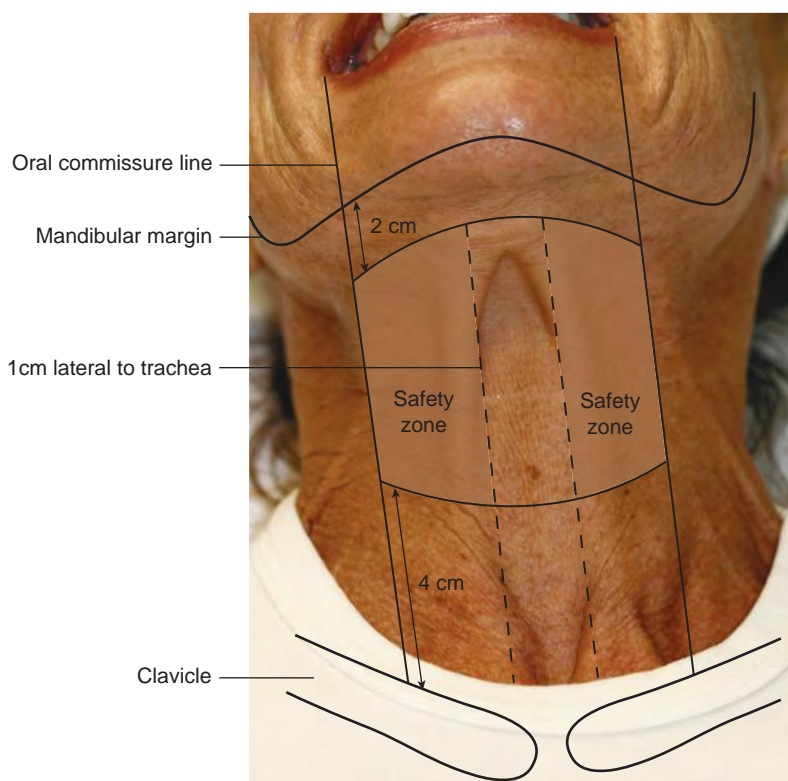


FIGURE 4 ● Neck band safety zone for botulinum toxin treatments. Copyright R. Small, MD.



● = 2.5 units Botox

FIGURE 5 ● Overview of botulinum toxin injection points and doses for treatment of neck bands. Copyright R. Small, MD.



FIGURE 6 ● Platysma muscle botulinum toxin injection technique. Copyright R. Small, MD.

thumb using the nondominant hand (Fig. 6). The muscle ridge is palpable beneath the skin. The needle is angled medially, at about 45-degrees to the neck, and inserted into the band. A slight increase in resistance can be felt as the needle moves from skin into muscle. The tip of the 30-gauge 0.5-inch needle should just pass into the muscle ridge, and botulinum toxin injected at that site.

- When getting started with this procedure, it is advisable to treat neck bands located more medially in the safety zone and limit the treatment to no more than two neck bands.
- Injecting deeply may penetrate the neck fascia resulting in undesired spread of botulinum toxin to deeper neck muscles that are integral in deglutination and neck stability.
- Injecting medial to the safety zone in the midline may involve the laryngeal muscles affecting speech.

Technique

1. Position the patient at a 60-degree reclined position.
2. Identify the neck band safety zone (Fig. 4).
3. Locate the medial neck bands for treatment within the safety zone by instructing the patient to contract the muscles as directed above.
4. Identify the injection points (Fig. 5).
5. Ice for anesthesia (optional).
6. Prepare injection sites with alcohol and allow to dry.
7. The provider is positioned on the side that is to be injected.
8. While the platysma muscle is contracted, insert the needle at least 2 cm inferior to the jaw in the superior portion of the neck band. Direct the needle medially and ensure that the needle tip is intramuscular and not just in the skin, using the technique described in Overview above. Inject 2.5 units of OBTX (Fig. 6).
9. The next injection point is 1–2 cm inferior to the first and OBTX is injected using the same technique. Injections are continued inferiorly to the lower neck, with a total of 3–5 injection points per band, depending on the band length.
10. For the second neck band, repeat the injection technique above.
11. Compression is not typically required.

Results

- **Reduction of neck bands** is evident 2 weeks after botulinum toxin treatment. Figure 1 shows contraction of the platysma muscle before (Fig. 1A) and 2 weeks after (Fig. 1B) botulinum toxin injection.
- **Improved neck contour with reduction of submental fullness** at rest may also be evident 2 weeks after botulinum toxin treatment.

Duration of Effects and Treatment Intervals

- Muscle function in the treatment area gradually returns by about 3–5 months after botulinum toxin treatment.
- Subsequent treatments with botulinum toxin may be performed when function of the platysma muscle is regained.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of neck bands. Below is a commonly encountered follow-up issue:

- **Persistent neck bands with platysma muscle contraction.** Patients may have greater muscle mass than anticipated in the treatment area and additional botulinum toxin may be required to achieve desired results. A touch-up procedure may be performed with 2.5 units of OBTX per injection site in the active neck bands, using the same method as described above. The combined total dose for the initial treatment and touch-up procedure should not exceed 20 units of OBTX per neck band. Reassess 2 weeks after touch-up. The efficacious dose of botulinum toxin for treatment of the platysma muscle is determined to be the initial dose plus the touch-up dose. Start with this total dose at the patient's subsequent platysma muscle treatment in 3–5 months.

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts section, Complications)
- Dysarthria (difficulty articulating)
- Dysphagia (difficulty swallowing), and in severe cases nasogastric tube placement
- Hoarseness
- Neck weakness

Complications are rare with treatment of neck bands, however, when they occur, they can be significant and problematic.

Dysarthria may result from impaired oral function due to injection of botulinum toxin into the platysma muscle. The superior platysma muscle inserts on the muscles of the lower face and can affect function of the corners of the mouth, lower lip, and chin. Botulinum toxin injection in the superior portion of the platysma muscle, close to the mandibular margin, can, therefore, impair oral function.

Dysphagia **neck weakness** and **hoarseness** may result from spread of botulinum toxin to the deeper muscles that lie below the platysma muscle (such as the sternocleidomastoid and other strap muscles and laryngeal muscles of the neck). Dysphagia can occur with very high OBTX doses (≥ 180 units); however, there has been a case report of dysphagia requiring a nasogastric feeding tube with 60 units of OBTX injected in the neck. Neck weakness is typically reported as reduced neck flexion in the supine position. Hoarseness is due to diffusion of botulinum toxin to the laryngeal muscles. There are no corrective treatment for these complications and they improve spontaneously as botulinum toxin effects wears off over 3–4 months.

Other Neck Botulinum Toxin Treatments

Horizontal neck lines. Static horizontal neck lines, also called necklace lines, may be treated using 1–2 units of OBTX just above or below the line, within the neck band safety zone. Injections are intradermal, spaced 1.5–2 cm along the line. The most prominent horizontal line is the focus of treatment. It is advisable to avoid treating

both neck bands and horizontal neck lines in the same visit, to limit botulinum toxin dosing in the neck.

Pricing

Charges for botulinum toxin treatment of neck bands range from \$600–\$800 per treatment for two neck bands or \$25–\$40 per unit of OBTX. This is an advanced treatment area and the price per unit is greater than that for the basic areas of the upper face.

Axillary Hyperhidrosis



FIGURE 1 ● Axillary hyperhidrosis.
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Primary axillary hyperhidrosis, defined as idiopathic focal excessive sweating, is estimated to affect more than 7.8 million people in the United States, with the highest incidence in adults aged 18–54 years. This condition impacts sufferers' quality of life through interference with social and occupational interactions and daily activities. Treatment of sweat glands in the dermis with botulinum toxin inhibits acetylcholine release, which decreases sweat production and reduces hyperhidrosis.

Indications

- Primary axillary hyperhidrosis

Anatomy

- **Sweat glands.** Sweat glands are located in the dermis and are sympathetically innervated by the acetylcholine neurotransmitter, which stimulates perspiration. Patients with axillary hyperhidrosis do not have an increased density of axillary sweat glands and the pathophysiologic mechanism of primary axillary hyperhidrosis is presumed to be due to sympathetic nervous system hyperactivity or dysregulation, resulting in excessive perspiration.

Patient Assessment

- **Diagnosis of primary axillary hyperhidrosis** is made after secondary causes of excessive sweating are excluded, such as spinal cord injury, peripheral nervous system pathology, hyperthyroidism, diabetes, malignancies, and others.
- **Diagnostic criteria** for primary axillary hyperhidrosis include focal, visible, and excessive sweating (Fig. 1) without apparent cause for at least 6 months’ duration and at least two of the following:
 - Bilateral sweating.
 - Impairment in daily activities.
 - Frequency of at least one episode per week.
 - Age of onset less than 25 years.
 - Positive family history (65% of patients have a positive family history).
 - Cessation of focal sweating during sleep.
- **Hyperhidrosis Disease Severity Scale** is a self-reported qualitative tool that may be used to assess the severity of axillary hyperhidrosis. The degree of disruption to daily activities is categorized on a four-point scale, where a score of 3 or 4 is considered as severe hyperhidrosis.

The Hyperhidrosis Disease Severity Scale is summarized in the table below.

Hyperhidrosis Disease Severity Scale	Description
	Underarm sweating is characterized as follows:
1	Never noticeable and never interferes with my daily activities.
2	Tolerable but sometimes interferes with my daily activities.
3	Barely tolerable and frequently interferes with my daily activities.
4	Intolerable and always interferes with my daily activities.

- A **stepwise treatment algorithm** is commonly used for axillary hyperhidrosis, which includes:
 - Initial therapy with over-the-counter antiperspirants.
 - Aluminum chloride 10–25% topical antiperspirant.
 - Intradermal injections of botulinum toxin.
 - Surgery with local sweat gland resection or endoscopic thoracic sympathectomy.

Treatment Goal

- Complete cessation of axillary perspiration or reduction of severity, such that the symptoms can be managed with over-the-counter antiperspirants.

Reconstitution

- Reconstitute 100 units of Botox Cosmetic powder with 4 mL of nonpreserved sterile saline (see Introduction and Foundation Concepts section, Reconstitution Method).
- Botulinum toxin products are not interchangeable and all references in this chapter to onabotulinumtoxinA (OBTX) refer specifically to Botox.

Starting Doses

- Women and men: 45–50 units of OBTX per axilla. A total of 20 injections per axilla are performed using 2.5 units of OBTX per injection point

Anesthesia

- Anesthesia is not necessary for most patients but an ice pack may be used if required.

Equipment for Iodine-Starch Test

- Iodine solution or swab (1–5%)
- Cornstarch
- Brush or gauze to wipe off excess starch
- Surgical marker
- Tape measure
- Alcohol
- Small sieve (optional)

Equipment for Treatment

- General botulinum toxin injection supplies (see Introduction and Foundation Concepts section, Equipment)
- Reconstituted Botox Cosmetic
- 30-gauge, 0.5-inch needle

Procedure Preparation and Overview

- Before treatment with botulinum toxin, the hyperhidrotic area is determined using the Minor's Iodine-Starch Test. Excessive perspiration is indicated with this test by a purple color change in the affected area when starch, iodine, and perspiration combine.
- To prepare for the starch-iodine test, patients are instructed to shave underarms and abstain from the use of over-the-counter deodorants or antiperspirants for 24 hours before the test.



FIGURE 2 ● Axilla painted with iodine solution for iodine-starch test. Copyright R. Small, MD.

- Botulinum toxin is injected intradermally for treatment of axillary hyperhidrosis. Effects may be diminished with deeper injection.
- Do not inject directly into ink marks to avoid inadvertently tattooing the skin.

Technique

Minor's Iodine-Starch Test

1. Position the patient supine on the treatment bed, with arms raised.
2. Dry the axilla and then paint with iodine solution, making sure to cover the area surrounding the axilla. Allow the iodine to dry (Fig. 2).
3. Sprinkle starch on the area using a sieve (Fig. 3).
4. Brush off excess starch powder and wait for 10 minutes (Fig. 4).
5. An intense purple color will be evident in the hyperhidrotic areas. Encircle the purple area with a surgical marker (Fig. 5) and document with photographs.
6. Clean the area inside the circle with alcohol to remove all the purple color and prepare the skin for injections. Use a surgical marker and tape measure to mark 20 evenly distributed injection points, 1.5–2 cm apart, per axilla (Fig. 6).

Botulinum Toxin Treatment

1. Using a 30-gauge 0.5-inch needle, inject 2.5 units of OBTX intradermally at each marked injection point. The needle is angled at 45-degrees to the skin surface, with the bevel up and the tip inserted just under the skin to approximately 2 mm in depth, to raise a wheal (Fig. 7). After injections, clean the area with alcohol to remove all marks.
2. Repeat this injection technique for the other axilla.
3. Compress injection sites.

Results

- Significant or complete reduction of underarm sweating occurs 1–2 weeks after treatment.



FIGURE 3 ● Starch powder applied to axilla for iodine-starch test. Copyright R. Small, MD.



FIGURE 4 ● Excess starch powder removed for iodine-starch test. Copyright R. Small, MD.



FIGURE 5 ● Circled hyperhidrotic area of purple coloration for iodine-starch test. Copyright R. Small, MD.



FIGURE 6 ● Injection points marked for botulinum toxin treatment of axillary hyperhidrosis. Copyright R. Small, MD.



FIGURE 7 ● Intradermal injection technique for botulinum toxin treatment of axillary hyperhidrosis. Copyright R. Small, MD.

Duration of Effects and Treatment Intervals

- Perspiration gradually returns by about 6 months after botulinum toxin treatment and subsequent treatments with botulinum toxin may be performed at that time.

Follow-Ups and Management

Patients are assessed 2 weeks after botulinum toxin treatment to evaluate for reduction of perspiration. Follow-up issues are rare and include the following:

- **Persistent perspiration in the treatment area.** This can be corrected with a touch-up procedure using 2.5 units of OBTX per injection site in the area of residual perspiration. Patients may be able to identify the area where residual perspiration is occurring and the treatment directed there. Otherwise, an iodine-starch test may be performed to identify the areas of perspiration for the touch-up procedure. Touch-up procedures for axillary hyperhidrosis typically require 10–20 units of OBTX per axilla. At subsequent visits, use 45–50 units of OBTX, as it still may be possible to achieve an adequate response with this dose.

Complications and Management

- General injection-related complications (see Introduction and Foundation Concepts section, Complications)

Botulinum Toxin Treatments in Multiple Areas

- As the dose used for treatment of axillary hyperhidrosis is large, it is recommended that treatment of other areas with botulinum toxin be reserved for a separate visit.

Pricing

Charges for botulinum toxin treatment of bilateral axillary hyperhidrosis are typically \$900–\$1200 per treatment or \$10–\$12 per unit of OBTX.

