Orbicularis oris, mentalis, depressor anguli oris

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Summary and Key Features

• Aging of the perioral and chin regions is characterized by facial perioral rhytides (so-called smokers’ lines or lipstick lines), decrease in vermilion fullness, inversion of the vermilion, lengthened appearance of the cutaneous portion of the upper lip, downward turn of the oral commissures, pre-jowl notch or sulcus, and chin dimpling. Also, prominence of the labiomandibular (marionette lines), labiomental, and nasolabial folds occurs.

• The goal of treatment of the lower face with botulinum toxin (BoNT) is to soften dynamic rhytides through muscular relaxation instead of completely paralyzing the target muscle.

• The muscular anatomy of the lower face is complex; therefore caution is advised when performing BoNT injections.

• BoNT can be used as monotherapy or as an adjunct to other procedures in lower face rejuvenation.

• BoNT as monotherapy can be used for younger patients whose primary concern is not volume loss, but rather fine dynamic and/or static radial perioral rhytides due to muscular activity.

• A combination treatment of BoNT and dermal fillers in the lower face has emerged as the gold standard for lower face rejuvenation

Introduction

Botulinum toxin (BoNT) chemodenervation has revolutionized cosmetic surgery. Botulinum toxin treatments complement, and in some cases preclude, traditional invasive surgical procedures. Chemodenervation with BoNT is the cornerstone of minimally invasive upper facial rejuvenation. The safety and efficacy of BoNT in the upper face have been extensively documented. However, BoNT use in the lower face is less well established in well-designed clinical trials.

In the lower face, treatment strategies are traditionally focused on volume restoration; however, controlling hypermobility is also essential. Botulinum toxin is used as monotherapy or as an adjunct to other procedures in lower face rejuvenation. Treatment options include dermal fillers, chemical peels, laser resurfacing, non-invasive tightening modalities, and facelifts (with or without chin/pre-jowl implants) (Table 18.1). Although rhytideotomy can reduce the nasolabial and labiomandibular folds, this procedure cannot enhance the lip region owing to its anatomy. The perioral tissues include supportive ligaments that must be preserved, and there is a high risk of motor innervation injury affecting the perioral area through a facelift. This is due to the buccal and marginal mandibular branches of the facial nerve, which course superficially, ramify extensively, and are challenging to identify. Motor innervation injury leads to muscle weakness. A combination treatment with BoNT and fillers in the lower face has emerged as the gold standard because it addresses a broader spectrum of facial aging changes, without the need for surgery.

This chapter aims to address the use of BoNT in the orbicularis oris, mentalis, and depressor anguli oris (DAO) muscles, as they directly affect the appearance of the perioral and chin regions.

Anatomy

The perioral region, also called the lip unit, is one of the facial cosmetic units. It extends from the base of the nose (subnasal) superiorly to the nasolabial folds laterally, and to the labiomental crease inferiorly. The free edges of the vermilion borders subdivide this region into the upper lip and lower lip. Below the labiomental crease is another facial unit, the chin.

The upper lip is subdivided into the cutaneous upper lip, the vermilion upper lip, and the philtrum. The lower lip is subdivided into the cutaneous lower lip and the vermilion lower lip.

The musculature of the perioral and chin area is complex and includes the orbicularis oris, risorius, DAO, zygomaticus major, zygomaticus minor, levator anguli oris, levator labii superioris alaque nasi (LLSAN), depressor labii inferioris, mentalis, and the platysma (Fig. 18.1).
Table 18.1 Treatment options

<table>
<thead>
<tr>
<th>Entity</th>
<th>Botulinum toxin</th>
<th>Dermal fillers</th>
<th>Laser resurfacing</th>
<th>Chemical peels</th>
<th>Non-Invasive tightening</th>
<th>Facelift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vermilion atrophy</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial perioral rhytides</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marionette lines</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-jowl sulcus</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chin dimpling</td>
<td></td>
<td>✓</td>
<td>✓</td>
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</tr>
</tbody>
</table>

Note: except for vermilion atrophy/inversion, all other entities are best treated with a combination of treatment options.

The orbicularis oris muscle is necessary for correct speech and allows for enunciation of the letters F, M, O, and V.

The mentalis muscle originates in the body of the mandible and inserts into the orbicularis oris muscle and the skin of the chin. It elevates and protrudes the lower lip, is important for drinking, and elevates the skin of the chin when showing doubt. The mentalis is innervated by the mandibular branch of the facial nerve.

The depressor anguli oris is shaped like a triangle with the vertex located at the angle of the mouth. DAO arises from the oblique line on the anterior mandible. Its fibers blend with the orbicularis oris and are inserted into the corner of mouth. The marginal mandibular branch of the facial nerve innervates this muscle. Its main action is pulling the angle of the mouth inferiorly and laterally.

Figure 18.1 Musculature of the lower face: a) levator labii superioris alaque nasi, b) levator labii superioris, c) zygomaticus minor, d) zygomaticus major, e) levator anguli oris, f) orbicularis oris, g) risorius, h) DAO, i) depressor labii inferiors, and j) mentalis.

The orbicularis oris muscle origins are in the deep surface of the perioral skin, the angle of the mouth, superiorly the median plane of the maxilla, and inferiorly the mandible. This muscle inserts into the mucous membrane of lips. It is innervated by the buccal and mandibular branches of the facial nerve. Its tonus closes the rima oris; its phasic contraction compresses and protrudes the lips, aiding mastication, expression, phonation, and the actions of whistling, sucking, and kissing. Additionally, when blowing this muscle has a role resisting distension.

The perioral and chin regions is characterized by radial perioral rhytides (so called smokers’ lines or lipstick lines), decrease in vermilion fullness, inversion of the vermillion, downward turn of the oral commissures, lengthened appearance of the cutaneous portion of the upper lip, pre-jowl notch or sulcus, and chin dimpling. Additionally, prominence of the labiomandibular (marionette lines), labiomental, and nasolabial folds can occur (Fig. 18.2A,B).

The pathophysiology of the aging perioral and chin regions is multifactorial, and culminates in the aforementioned aesthetically undesirable appearance. Extrinsic factors, including smoking and sun exposure, can potentiate intrinsic factors. An article published in 1965 by Gonzalez-Ulloa & Flores, perhaps the first comprehensive study of facial aging elements, described the decreased thickness and elasticity of skin, decreased adherence between the skin and subcutaneous tissue, sagging of the soft tissues, absorption of fat, resorption of the craniofacial skeleton, and weakening of the muscles.

The paradigm of muscular involvement in the aging face has shifted. It was thought that muscle weakness and laxity caused downward displacement of soft tissue, whereas current theories implicate persistent contraction...
and increased resting tone in the muscle’s role in facial aging. Repetitive contractions wrinkle the skin in the same way the act of folding and unfolding a paper eventually causes a crease. The increased resting tone exerts constant pressure on the underlying bone, favoring its erosion and posterior remodeling, and projects underlying fat anteriorly. This forms the rationale for BoNT in facial rejuvenation and explains its excellent results when used consistently.

The marionette lines are a consequence of facial aging and form as curvilinear wrinkles extending downward from the oral commissures to the jawline. The etiology of marionette lines is unclear, but they are probably related to DAO hyperactivity, the effects of gravity, mandible and maxillary bone resorption, and fat absorption.

A prominent mentalis muscle can accentuate the horizontal labiomental crease, or produce a cobblestone appearance on the chin. Both effects are accentuated with volume loss.

The labiomental fold is a horizontal fold located between the lower lip and the chin (see Fig. 18.2A,B). It is produced by the depressor anguli oris and the mandibular ligament. The nasolabial fold will be addressed in another chapter.

The pre-jowl sulcus develops with aging as an indentation of the external inferior margin of the jawline between the chin and the jowl, anterior to the marionette line. This notching increases with aging due to atrophy of the soft tissues and bone resorption.

The repetitive muscular actions of the orbicularis oris and volume loss contribute to the radial perioral rhytides.

**Differences in the use of BoNT for the upper and lower face**

A ‘frozen’ corrugator or procerus muscle affects facial expression, but does not present any functional problems. In contrast, paralysis of the orbicularis oris, DAO or mentalis muscles affect important functions such as oration, expression, and mastication. Therefore, the goal in treatment of the lower face is to soften the rhytides through muscular relaxation rather than complete paresis of the target muscle.

Beyond that, patients who require precise enunciation and/or tight control of their lips such as singers, musicians, and public speakers are not good candidates for rejuvenation of the lower face with BoNT treatment.

The anatomy of the lower face is complex; therefore caution is advised when administering BoNT injections.

**Pearl 1**

Always undertreat the lower face when using botulinum toxin.

Volume loss is often prominent in lower face aging; therefore adjunctive use of fillers is usually necessary.

**Rejuvenation**

**Patient selection for botulinum toxin perioral and chin rejuvenation**

Patients are encouraged to verbalize their concerns about their face and their expectations of any intervention. A handheld mirror is indispensable during the consultation. If the patient has realistic expectations and the physician feels that these expectations can be met with an acceptable safety profile, the likelihood of success is maximized.

Botulinum toxin injections are extremely safe, but patients who require precise enunciation and/or tight
control of their lips such as singers, musicians, and public speakers are not good candidates for lower face and more specifically perioral rejuvenation with BoNT.

After understanding the patient’s wishes, the physician must choose which approaches are most effective and safe (see Table 18.1). For the lower face, usually a combination of approaches is necessary. Patients whose principal concern is not volume loss, but the end results of muscle hyperactivity, can benefit from BoNT as monotherapy (Table 18.2).

Recently, Carruthers et al have shown that the combination treatment of BoNT and fillers is safe, more effective and longer lasting than either treatment alone.

Botulinum toxin and fillers can be used concomitantly to enhance radial perioral rhytides, the downward turn of the oral commissures, the lengthened appearance of the cutaneous upper lip, the pre-jowl sulcus, and chin dimpling. Additional indications include reduction of labiomandibular (marionette lines), labiomialental, and nasolabial folds.

**Target muscle**

**Orbicularis oris**

Relaxation of the orbicularis oris muscle through the use of BoNT can reduce radial perioral rhytides and afford a slight increase in vermilion border eversion and exposure.

**Mentalis**

BoNT injection into the mentalis muscle can reduce chin dimpling (aka peau d’orange chin) and reduce the prominence of the labiomialental crease. It is very effective for the young patient with chin dimpling. However, for chin dimpling and labiomialental crease due to volume loss, fillers are necessary adjuncts. Moreover, BoNT can be useful as an adjuvant to fillers for patients with mentalis diastases causing a bipartite chin.

**Depressor anguli oris**

BoNT injection into the DAO can reduce marionette lines, the downward turn of the oral commissures, and a long nasolabial fold, although again dermal fillers are generally required to optimize outcomes.

**Preparation of botulinum toxin solution**

Clinicians should use the BoNT dilution with which they are most familiar. Our preferred dilution of BoNT-A (Botox®, Allergan Inc., Irvine, CA, USA) is 2.0 mL of preserved normal saline per 100-unit vial, yielding a concentration of 5 units of Botox®/0.1 mL. Injection occurs with a half-inch (13 mm) 32-gauge needle attached to a 1 mL syringe (1 mL syringes are commercially available with 50 gradation marks per syringe, allowing for precise dosing at 1 unit of Botox® per gradation mark).

For the radial perioral rhytides a 1 mL syringe containing 0.1 mL of the solution described above is diluted with 0.9 mL of preserved normal saline. A concentration of 5 units of Botox®/mL is obtained, facilitating the injection of 1 unit or less per point, and allowing a greater spread of the toxin.

**Dosage and injection technique**

Prior to treatment, a topical anesthesia is applied to the target region. The authors use 4% lidocaine.

When BoNT and fillers are used in the same session, the authors prefer to administer fillers first.

Before injection the area is cleaned with an alcohol pad and the patient is asked to repeatedly contract and relax the target muscles, helping to aid the visibility of the targets.

The amount of units below refers to Botox®.

**Orbicularis oris**

Injections are placed along or slightly above the vermilion border. Administration close to the vermilion border minimizes the spread of the toxin to the surrounding musculature (ILSAN and zygomaticus minor), thus reducing the risk of complications (Fig. 18.3A). Injections are superficial, just under the dermis.

**Pearl**

Inject the orbicularis oris near the vermilion border.

For the upper lip, the authors start with 1-2 units at four uniformly spaced sites, up to 4 units. For the lower lip, the authors inject 1 unit, up to 2 units, at two uniformly spaced sites.

**Depressor anguli oris**

Each DAO is treated with one injection into the mid to lower thirds of the muscle where its fibers are more numerous and are interspersed with fibers of the platysma, which also contributes to the inferior pull of the oral commissures and accentuates the marionette lines.

The injections should be done laterally to the oral commissures to avoid injecting the depressor labii inferioris, which can cause lip protrusion. Care must also be taken to avoid injecting so laterally that the buccinator muscle is affected. The anterior border of the buccinator
Figure 18.3 Points of BXT injection: (A) orbicularis oris muscle; (B) depressor anguli oris; (C) mentalis muscles.
muscle can be found by asking the patient to clench the teeth. The injection can be placed slightly anterior to this landmark (Fig. 18.3B).

**Pearl 3**
Place injections into the DAO lateral to the oral commissure and medial to the anterior border of the buccinator muscle.

Two units injected below these points at the inferior border of the mandible bone can be useful to further smooth the inferior portions of the marionette lines.

The authors usually inject 4 units-side, but some authors prefer 1–3 units-side, up to 7.5 units-side.

**Mentalis muscle**
The mentalis muscle may be injected with 3–5 units of BoNT lateral to the midline at the chin’s prominence (Fig. 18.3C).

**Pearl 4**
When injecting the mentalis, stay close to the midline of the inferior portion of the chin.

**Complications**

**Orbicularis oris**
Complications include lip asymmetry, difficulty with articulation or elocution, and inadvertent whistling. Chemodenervation can also lead to difficulty drinking with a straw and pursing the lips. Some patients may present lengthening of upper cutaneous lip.

Placing injections just under the dermis, into the most superficial layer of the orbicularis oris, can mitigate the risk of these complications, as the function of the deeper muscle fibers remains intact.

**Depressor anguli oris**
Injections placed too medially can affect the depressor labii inferioris and cause flattening of the contour of the lower lip (Fig. 18.4). Injections placed too high may reach the orbicularis oris and result in problems with speech and suction. Additionally, flaccid cheeks, asymmetric smile, and lower lip weakness can occur.

**Mentalis**
Paresis of the depressor labii inferioris can occur when an injection intended for the mentalis muscle is placed too laterally, whereas paresis of the orbicularis oris is a result of the injection being placed too superiorly; these may affect speech or sphincteric function.

**Further reading**


Gonzales-Ulloa M, Flores ES 1965 Sensity of the face: basic study to understand its causes and effects. Plastic and Reconstructive Surgery 36:239–246

