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Anatomic Considerations for Treatment with Botulinum Toxin

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- Basic treatment
  - *Frown lines/glabellar lines (procerus and corrugator supercili muscles)*
- Advanced treatment
  - *Forehead wrinkles (frontalis muscle)*
  - *Crow's feet (orbicularis oculi muscle)*
  - *Lower lid lines (orbicularis oculi muscle)*
  - *Lateral recruitment lines (orbicularis oculi muscle)*
  - *Bunny lines (nasalis muscle)*
  - *Lip lines (orbicularis oris muscle)*
  - *Downturned oral commissure (depressor anguli oris muscle)*
  - *Chin dimpling (mentalis muscle)*
  - *Masseter hypertrophy (masseter muscle)*
  - *Vertical platysmal bands (platysma muscle)*
  - *Necklace lines (platysma muscle)*
- Summary
- References

Treatment of facial and neck wrinkles with botulinum toxin type A (Botox, Allergan, Irvine, California) remains by far the most common aesthetic procedure performed in the United States. More than 3.2 million of these procedures were performed in 2005, compared with 2.8 million in 2004 and only 65,000 in 1997 [1]. During 2005, botulinum toxin type A injections accounted for 28.8% of all cosmetic procedures (surgical and nonsurgical). Botox acts by inhibiting the release of acetylcholine (neurotransmitter) at the neuromuscular junction, thereby producing partial chemical denervation of the muscle and a resultant localized reduction in muscle activity [2]. This article reviews the anatomic basis for the treatment of facial and neck rhytids caused by hyperfunctional muscle activity. The sole U.S. Food and Drug Administration–approved indication for the cosmetic use of Botox is the treatment of hyperfunctional procerus and corrugator supercili muscles, which are the muscles responsible for creating glabellar (frown) lines; however, any muscle of the face can be treated "off-label" as long as one uses the same principles used to treat the glabellar lines.

Common facial wrinkles and lines are the result of other hyperfunctional muscles (Box 1). Therefore, an understanding of facial and neck muscle anatomy is essential for optimal results and advanced applications. It is important to keep in mind that this anatomy varies slightly from one individual to another, among genders, and among races. Adding to the complexity is the significant amount of misinformation that exists in the medical literature. Many texts and academic papers use inconsistent or incorrect nomenclature, incorrect descriptions of muscle action, and incorrect anatomic diagrams. The intent of this article is to correctly describe facial and neck anatomy as it pertains to cosmetic Botox treatments and point out some of the misconceptions that are present in the literature. This information should help to improve results while avoiding pitfalls.

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Box 1: Common cosmetic Botox treatments: treatment site, muscles targeted

Upper face
Forehead, frontalis
Glabella, procerus and corrugator supercili
Crow's feet, orbicularis oculi
Chemical browlift, orbicularis oculi
Lower lid lines, orbicularis oculi
Bunny lines, nasalis
Lateral recruitment lines, orbicularis oculi

Lower face
Lip lines, orbicularis oris
Downturned oral commissure, depressor anguli oris
Chin dimpling, mentalis
Masseter hypertrophy, masseter

Neck
Platysmal bands, platysma
Necklace lines, platysma

Basic treatment

Frown lines/glabellar lines (procerus and corrugator supercili muscles)

The muscles of facial expression are all cutaneous muscles that are innervated by the facial nerve (cranial nerve VII). These muscles lie within the superficial fascia, originate from fascia or bone, and insert into the skin [3]. Many of these muscles are intimately associated with one another. When injecting botulinum toxin A, it is helpful to visualize the underlying muscle anatomy and attempt to inject the actual muscle belly. Typically, the glabellar region is treated with several injections targeted at the hyperkinetic procerus and corrugator supercili muscles (Fig. 1). The procerus muscle is a single, flat, midline muscle that is oriented vertically and originates from the nasal bones to insert into the subcutaneous tissues between the medial brows and slightly more superiorly. Contraction of this muscle produces one or more transverse (horizontal) wrinkles in the region of the nasion (root of the nose). Therefore, one or more Botox injections targeted at the belly of this muscle improve transverse nasal lines and other horizontal glabellar lines, if present. In some individuals, however, these transverse lines may not be present. Careful evaluation of the glabellar region is required to assess whether procerus treatment is indicated.

The vertical glabellar lines are often paired and may be symmetric or asymmetric. These lines are primarily the result of action of the paired corrugator supercili muscles. The inferior aspect of these vertical rhytids may have an oblique or horizontal portion caused by the procerus muscle. The corrugator supercili muscles originate from the procerus muscle medially and insert, laterally, into the orbicularis oculi muscle (by interdigitation) and the soft tissues just at and slightly above the medial

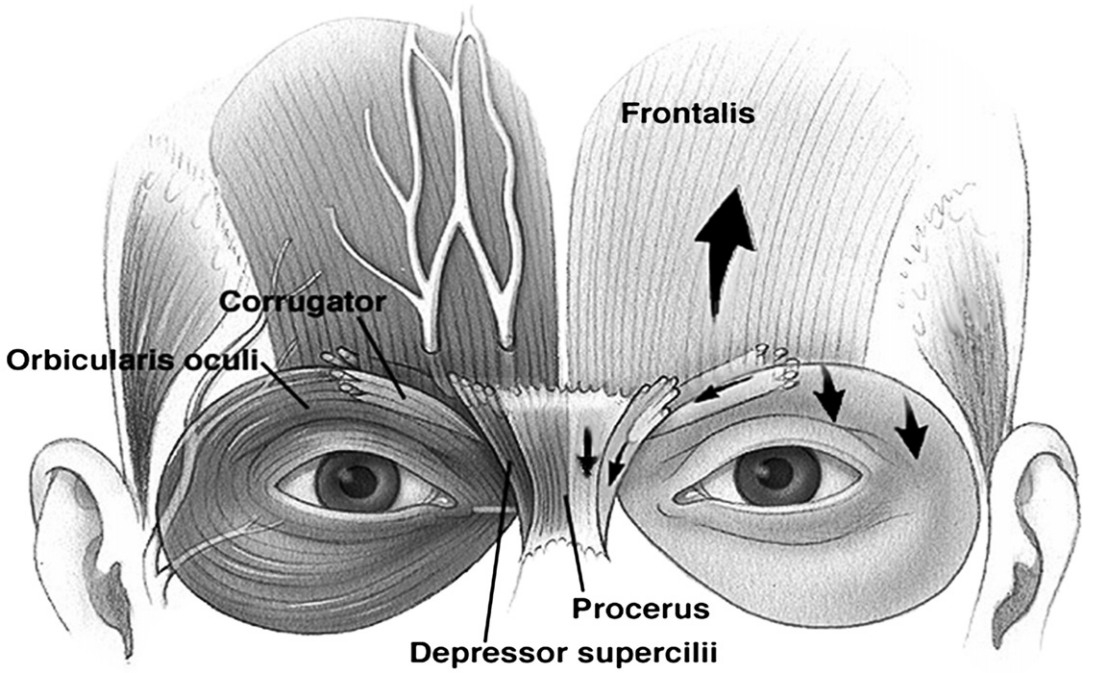

Fig. 1. Fronto-orbital anatomy. (*From* Maas CS. Botulinum neurotoxins and injectable fillers: minimally invasive management of the aging upper face. Facial Plast Surg Clin North Am 2006;14(3):242; with permission.)