Facial Anatomy
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Abstract. Botulinum toxin acts at the neuromuscular endplate, which requires precise delivery of the drug to achieve a desired clinical result. A thorough understanding of the complex anatomic structures of the face and their effect on facial form and function, coupled with an appreciation of facial esthetics and the balanced muscle actions that produce resting and active facial form, will result in accurate and reproducible clinical effects. Utilizing some general anatomic principles in combination with specific individual facial features and variations will enable the physician to consistently find the optimum injection sites and combination of other therapies for desired outcomes.

For the purposes of this discussion, we will first discuss some general features of facial anatomy that are important when planning procedures involving the face or when treating facial pathology in general. Second, the face will be divided into three vertically oriented dynamic areas, including the upper face and periorbital region, midface and perioral region, and finally the lower face and neck.

General Considerations

Facial Blood Supply
The face is supplied by various branches of the internal and external carotid system. Understanding this complex interaction, watershed areas, and danger areas is imperative in understanding patterns of disease spread and potential complications of any procedure involving the face.

The internal carotid system enters the skull at the carotid canal and immediately turns anteromedially toward the cavernous sinus and ultimately, the circle of Willis. From this point, the internal system gives off the ophthalmic arteries, which course anteriorly through the optic canal to enter the bony orbit. Once in the orbit, it divides into several branches, including the supraorbital and supratrochlear arteries. These vessels emerge from the supraorbital rim within their neurovascular bundles at the supraorbital and supratrochlear notches, respectively. Occasionally, the supraorbital nerve is completely encircled in bone at its exit, called the supraorbital foramina. These vessels course deep to the frontalis muscle in the deep connective tissue layer of the scalp, supplying the medial periorbital and scalp tissues of the anterior forehead.

The external carotid artery contributes several branches to supply the face. Laterally, just deep to the dermis and anteroinferior to the tragus, the external carotid artery terminates in two branches. The superficial temporal artery runs immediately subdermal at this level, making it a consideration in flap elevation in facelift surgery. The artery continues anteromedially deep to the facial muscles to anastomose with branches of the supraorbital and supratrochlear vessels.

The second terminal branch of the external carotid is the internal maxillary artery. The vessel courses medially and deep into the infratemporal fossa behind the mandibular ramus. It gives off the inferior alveolar artery into the body of the mandible, supplying the lower gingiva, and finally emerging as the mental artery from the mental foramina to supply the lower lip and chin. Further medially, the internal maxillary artery gives off another important branch, called the infraorbital artery. The artery courses anteriorly through the infraorbital canal in the floor of the orbit to exit the infraorbital foramina and supply the midface and nasal dorsum. This vessel will also anastomose with branches of the supraorbital and supratrochlear vessels (Fig 1).

Another major blood supply to the face comes from the facial artery, which divides off the external carotid lower in the neck. The vessel then ascends deep to the posterior belly of the digastric, in close relation to the submandibular gland, to cross the mandible at the facial notch near the anterior surface of the masseter muscle. The artery then courses medially toward the oral commissure in a plane deep to the facial muscles, where it gives off two labial branches. The inferior labial artery supplies the lower lip and chin, and the superior labial artery, which supplies the upper lip, alar rim, columella, and membranous septum, contributes to Kiesselbach’s plexus (Little’s area) on the anterior nasal septum. The main trunk continues into the nasolabial fold deep to the zygomaticus minor, emanating as the an-
gular artery in the subdermal plane near the base of the nasal ala. This artery supplies the nasal dorsum and medial cheek and ultimately anastomoses with the internal carotid branches near the medial canthus (Fig 2).

All of the vessels discussed have diffuse anastomotic networks with each other, both ipsilaterally and across the midline. These anastomoses form an important connection between the internal and external carotid sys-

Figure 1.  p. 1520, Fig 10.79: artery, deep. 1

Figure 2.  p. 1518, Fig 10.77: artery, superficial. 1
tems through which flow can reverse in situations of vascular occlusion and disease.²

**Facial Venous Drainage**

The majority of venous drainage follows the patterns described for the arterial circulation. The supraorbital and supratrochlear veins run with their arteries deeply through the orbit, terminating in the superior and inferior orbital veins. Both of these veins then drain into the cavernous sinus, creating a potential portal for disease spread intracranially. For this region, this area around the nasal dorsum and medial periorbital region has become known as the “danger triangle.” The scalp veins also anastomose via their emissary veins with intracranial meningeal veins, thus increasing the risk of disease spread.

Superficially, the angular vein runs parallel to the facial artery across the mandible, becoming the anterior facial vein and contributing to the common facial vein. The superficial temporal vein also parallels its artery to become the retromandibular vein. The retromandibular and common facial veins drain together in a variable pattern in to the external and internal jugular veins (Fig 3).

**Facial Lymphatics**

The lymphatic drainage of the face follows several general patterns, with some variability. These patterns are critical for spread of infectious and neoplastic disease from various regions of the face. The forehead, lateral temporal, frontal, and periorbital regions drain into parotid or intraparotid lymph nodes initially and then drain into the upper jugular chain.

The medial midface region, including the glabella, nose, nasolabial fold, medial cheek, upper lip, and medial canthal regions, drains into the submandibular nodes. Finally, the lower face, including the lower lip and mentum, drains into the submental nodes. The jugular chain serves as the second-echelon lymph nodes for both the midface and lower face regions (Fig 4).

**Cutaneous Sensory Innervation of the Face**

All facial skin from the chin to the scalp vertex is innervated by three branches of the trigeminal nerve (cranial nerve V; Fig 5). The ophthalmic division (V1) supplies the skin over the forehead, glabella, and upper dorsum of the nose. Originating at the semilunar ganglia, the nerve crosses the cavernous sinus to enter the orbit through the superior orbital fissure. The nerve
then divides into a lacrimal branch to the upper lateral lid, a nasociliary branch to the glabella and nasal dorsum, and the larger frontal branch. The frontal branch further ramifies into a supraorbital and a supratrochlear division, which run with their respective vessels to supply the forehead and periorbital regions.

The maxillary division (V2) supplies the skin of the midface. The nerve originates at the semilunar ganglia and exits the skull via the foramina rotundum, where it gives of the zygomaticotemporal and zygomaticofacial branches to supply the zygoma and lateral canthal regions. The nerve then continues through the infraorbital canal to supply the upper alveolus, gingiva, nasal floor, and palate, exiting the infraorbital foramen with its vascular bundle to supply the cheek, lower lid, upper lip, and lower nose.2

The mandibular division (V3) of cranial nerve V supplies the skin of the lower lip, chin, lower mandibular region, lower gingiva, and around the ear and temporal region. This division arises from the semilunar ganglia similarly to the other two divisions. The nerve then exits the skull through the foramen ovale to enter the infratemporal region, where it divides into several branches. The buccal branch innervates the buccal mucosa and cheek skin laterally. The auriculotemporal branch supplies the skin over the preauricular region and temporal scalp. Finally, the inferior alveolar nerve enters the inferior alveolar canal with its artery to supply the lower alveolar ridge and exit the mental foramen as the mental nerve to supply the chin and lower lip (Fig 6).

Muscles of Facial Expression

Understanding the facial musculature is critical to any discussion of botulinum toxin use in the head and neck. Our understanding of these complex muscles has evolved over the centuries to include functions relating to sphincters for eye protection and oral competence. They also assist in articulation for speech and bolus preparation in the oral cavity. Finally, they must convey our complex emotions and expressions to the world around us. These “muscles of facial expression” are all
embryologic derivatives of the second pharyngeal arch (hyoid arch) and as such, are all innervated by the nerve of the second arch (cranial nerve 7) known as the facial nerve.

The facial nerve follows a circuitous route through the internal auditory canal into the inner ear, middle ear, and mastoid bone to emerge from the skull at the stylomastoid foramen. After exiting the bony canal, the nerve immediately gives off three small branches supplying the postauricular muscles, posterior belly of digastric, and stylohyoid, respectively. The main trunk then enters the substance of the parotid to divide at the pes anserinus ~1.5 cm distal to the foramen. At this point, the nerve divides variably into its five terminal divisions (Fig 7).

The temporal branch courses superficial to the zygomatic arch, providing motor innervation to the orbicularis oculi, frontalis, and corrugator muscles. The zygomatic branch courses toward the lateral canthus to further innervate the orbicularis oculi above and below the canthus. The buccal branch supplies the muscles of the midface, including the zygomaticus major and minor, levator labii superioris, levator anguli oris, and the buccinator. The mandibular division dips below the angle of mandible and back again to supply the orbic-
ularis oris, depressor anguli oris, and mentalis muscles. Finally, the cervical branch courses into the neck to innervate the platysma muscle. The nerve in general exits the substance of the parotid gland and follows a more superficial course distally to lie in the subdermal plane at the level of the muscles it innervates. Certain “danger zones” have been identified to protect the nerve in superficial regions like the zygomatic arch or near the submandibular gland (Fig 8).

Due to the small caliber and proximity of these muscles to one another, specific identification of selective muscle bellies can be difficult. Having the patient perform an exaggerated muscle function task based on the known primary action of each muscle will help make its belly more easily palpable and exaggerate the potential rhytids requiring treatment. It is also important to keep in mind the relatively superficial depth of these muscles. These muscles lie immediately below the skin and dermis within the subcutaneous fat, which can vary in thickness from site to site on the face and from person to person. This muscular plane is invested by the superficial cervical fascia and is commonly referred to as the superficial musculoaponeurotic system layer. Electromyographic localization of each muscle during rest and function allows the most accurate placement of toxin. Next, we will discuss these specific muscles and their actions and describe some of the more commonly discussed complaints associated with each.

Muscles of the Upper Face

Frontalis. This muscle has no bony attachments, as its fibers arise from the scalp occipitofrontalis muscle and aponeurosis and terminate on the skin and dermal tissue of the anterior forehead and brow. The muscle runs in a vertical direction, and as such, contraction will result in horizontal forehead rhytids above the brow level.

Corrugator supercilii. This muscle attaches to the orbital rim medially and inserts with the frontalis on the skin more laterally. Contraction of this muscle produces vertical rhytids known as “frown lines” in the glabella and lower median forehead.

Procerus. The procerus muscle draws down the medial brow by attaching to the facial aponeurosis overlying the nasal bones and inserting on the skin of the eyebrow and lower forehead. Contraction of this muscle produces horizontal rhytids over the nasal dorsum, or “glabellar lines” (Fig 9).

Orbicularis Oculi. This is a broad, flat muscle that encircles the palpebral fissure. The muscle contains three parts, including the orbital portion, which is the outer
rim blending over the frontalis to end in the lateral canthus and orbit. The thinner, central preseptal portion arises from the medial palpebral ligament and ends at the lateral palpebral raphe. Finally, the pretarsal part forms the inner ellipse of muscle (Fig 10). Contraction of this muscle acts as a sphincter for eye closure. Hyperactivity can cause “crow’s feet” rhytids at the lateral orbital margin.

It must be remembered that all of the upper face muscles contribute to brow position. This is a critical element in the esthetic appearance of the upper face and must be balanced to achieve an acceptable and pleasing result.

**Muscles of the Midface**

**Nasalis.** This muscle arises from the maxilla and sends fibers over the nasal dorsum to decussate in the midline at an aponeurosis at the bridge of the nose. The muscle functions to open the nasal aperture and valve during exercise or deep inspiration. Excess contraction can cause “bunny scrunch lines” on the nasal dorsum.

**Levator Labii Superioris Alaeque Nasi.** This muscle arises from the upper part of the frontal process of the maxilla and passes obliquely, lateral to the alar cartilage on the lateral nose to insert on the upper lip, blending with the orbicularis. Contraction deepens the nasolabial fold, dilates nasal ala, and everts the upper lip.

**Levator Labii Superioris.** This muscle arises from the inferior orbital margin and inserts into the upper lip muscular slip, lateral to the levator labii superioris alaeque nasi. Contraction raises and everts the upper lip and deepens the nasolabial fold.

**Zygomaticus Minor.** The zygomaticus minor arises from the lateral surface of the zygoma and inserts into the muscular slip of the upper lip, just lateral to the levator labii superioris. Contraction will cause elevation of the upper lip, exposing the maxillary teeth, such as in smiling. This muscle also contributes to the nasolabial fold, as contraction of fibers interdigitating with the skin will deepen this fold over time.

**Zygomaticus major.** This muscle runs from the zygomatic bone to the modiolus, blending with the orbicularis oris. Contraction draws the angle of the mouth upward, such as in laughing.
Levator Anguli Oris. This muscle arises from the canine fossa and inserts on the lateral comissure muscular slip, known as the modiolus. The modiolus is best described as a dense, fibromuscular interface of the muscles contributing to oral commissure movement and function by acting as a scaffold for muscles to pull on. The levator anguli oris also aids in smiling and contributes to the nasolabial fold, again via interdigitating skin fibers, which deepen the fold with repeated use.

Buccinator. The buccinator forms the lateral border of the oral cavity between the alveolar ridge of the maxilla and mandible. It originates on the stylomandibular raphe and inserts into the orbicularis sling. This muscle
assists in bolus control in chewing and in the oral phase of swallowing. (Fig 9).

Orbicularis Oris. The orbicularis oris is divided into two parts: the pars peripheralis, which attaches as a circular sling to each commissure at the modiolus, and the pars marginalis, deep to the vermilion border and mucosal lip surface (Fig 11). Contraction functions as the primary oral sphincter. Hyperfunction with time can lead to fine “lipstick lines” around the lips. As such, experience and careful discussion with the patient about possible unwanted effects and the need for future adjustment and titration are absolutely critical before chemodenervation in this region.

Muscles of the Lower Face and Neck

Depressor Labii Inferioris. The depressor labii inferioris arises from the mandible and inserts on the skin and mucosa of the lower lip, medial to the mental foramen. Contraction draws the lip downward and everts the lip.

Depressor Anguli Oris. This muscle originates at the mental tubercle on the mandible, lateral to the mental foramen, and inserts on the lateral lower lip and modiolus. Contraction causes the angle of the lower lip to depress and open the mouth. Increased use can cause radially oriented lower lip rhytids, known as “marionette lines.”
Mentalis. The mentalis arises from the mandible and inserts on the skin of chin, inferior to its origin. Thus, contraction pulls the chin and lip upwards and wrinkles the chin. Overuse may account for a “poppy chin” pincushioning effect on the mentum.

Platysma. This broad, sheetlike muscle arises from the fascia over the upper chest and clavicle and extends over the anterolateral neck to meet in the midline at the lower chin margin. The muscle then extends laterally over the mandible body to attach to the lateral lower lip and subdermal tissue of the lower face. With increasing age, ptosis of the muscle, skin laxity, and thinning of subcutaneous tissues create platysmal banding as a cosmetic issue in some patients.

Varying concentrations of botulinum toxin to the upper lip muscles may be used in balancing upper lip position, such as in patients with facial paralysis and synkinesis, and in softening deep nasolabial rhytids. Balancing the upper and lower lip muscles poses a great challenge for the clinician. The symmetry must be managed for upper and lower lip both in repose and during a host of complex facial tasks and expressions. Clearly,
from the number of muscles contributing to this coor-
dinated movement, restoration of symmetry will re-
quire titration and modification by even the most expe-
rienced clinicians. Botox® use in patients with facial
synkinesis and paralysis has contributed much to im-
proved facial symmetry and has provided a less-inva-
sive option for patients wishing to avoid traditional
surgical procedures. Knowledge of specific muscle in-
sertions and origins can prevent toxin diffusion and
minimize unwanted side effects. This is illustrated well
around the globe, where diffusion can impair either
rectus muscle function, leading to diplopia, or levator
muscle function leading to upper lip ptosis (Figs 12 and
13).

Conclusions
A functional understanding of the actions of the various
muscles of facial expression discussed is of paramount
importance when using chemodenervation treatment to
alter muscular function. This knowledge must exist
within the overall spectrum of facial anatomic rela-
tionships, including vascular supply, nerve position, and
facial compartments, to provide the patient with all of
their treatment options, manage complications appro-
priately, achieve optimal results, and avoid unwanted
side effects.

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