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Understanding the Perioral Anatomy

Tracey A. Hotta, RN, BScN, CPSN, CANS

Rejuvenation of the perioral region can be very challenging because of the many factors that affect the appearance of this area, such as repeated muscle movement causing radial lip lines, loss of the maxillary and mandibular bony support, and decrease and descent of the adipose tissue causing the formation of "jowls." Environmental issues must also be addressed, such as smoking, sun damage, and poor dental health. When assessing a client for perioral rejuvenation, it is critical that the provider understands the perioral anatomy so that high-risk areas may be identified and precautions are taken to prevent serious adverse events from occurring.

The lips function to provide the ability to eat, speak, and express emotion and, as a sensory organ, to symbolize sensuality and sexuality. To accomplish this multitude of functions, lips require a complex system of muscles and supporting structures. The surrounding complex of anatomical relationships of the muscles attached to the lips may be organized by *classifications of aging* or by *anatomical region*.

CLASSIFICATIONS OF AGING

Aging lips can be classified into three categories (Beer, 2007):

Group 1—Nice shape and definition (Figure 1): These clients have a nice shape (vermillion) and definition (vermillion border) but wish for enhancement. The vermillion is composed of numerous capillaries, which give its characteristic pink color. Around the mouth is the vermillion border, a fine white line that accentuates the color difference between the vermillion and normal skin. Lip enhancement typically involves injection of the wet–dry junction to gently inflate and cause lip eversion. Injection into the lateral upper lip border should be done to avoid the fade-away lip. The client may also require injections into the vermillion border to further highlight or define the lip. The injections may be performed by linear threading (needle or cannula) or serial puncture, depending on the preferred technique of the provider.

Group 2—Atrophic lips (Figure 2): These clients have atrophic lips, which may be due to aging or genetics, and are seeking augmentation to make them look more youthful. After an assessment and counseling as to the limitations that may be achieved, a treatment plan is established. The treatment would begin with injection into the wet–dry junction to achieve desired volume; additional injections may be performed into the cupid's bow and/or philtral columns to further contour the lips.

Group 3—Lip atrophy and vermillion disappearance (Figure 3): The perioral lines are observed at the edge of the white roll of the lip where the orbicularis oris is attached to the dermis with no interposed fatty layer. These lines typically start in the 30s and increase in length and depth with aging. They may be more apparent with increasing sun exposure, smoking (free radical theory of degradation), lifestyle (poor nutritional diet, exercise, and rest habits), and genetic predisposition.

Other contributing factors of the aging lip include soft-tissue volume loss, maxillomandibular resorption, and repetitive pursing of the lips. These contributing factors result in lengthening of the upper lip with loss of definition of the lip margin, flattening of the philtral columns, loss of projection of the cupid's bow, and creation of the marionette line.

These clients have loss of lip definition and/or perioral lines and require more attention to technique and other adjunctive treatments. Injection treatment may involve filling each individual perioral line and/or defining the lip border by injecting and strengthening the vermillion border to minimize the appearance of the perioral lines.

ANATOMICAL REGION

There are 12 facial muscles that affect the shape and function of the perioral area.

Tracey A. Hotta, RN, BScN, CPSN, CANS, is the owner and president of TH Medical Aesthetics. She is the past president of ASPSN, Editor of the *Plastic Surgical Nursing* journal, and is a Managing Partner of ACE+ Academia a div of HsuHotta Inc.

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Address correspondence to Tracey A. Hotta, RN, BScN, CPSN, CANS, 75 Cricklewood Cres, Thornhill, ONT L3T-4T8, Canada (e-mail: tracey@hotta.ca).

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FIGURE 1. Lip classification 1. Photography by Tracey Hotta. Used with permission.

Muscles in the perioral region can be classified according to their origins and insertions, as well as by their locations, with respect to the major structures.

Group 1—Muscles that insert into the modiolus: The modiolus is a fibrous meeting point where seven muscles connect. It is located lateral and slightly superior to each angle of the mouth. It derives its motor nerve supply from the facial nerve and its blood supply from labial branches of the facial artery (Table 1).

Group 2—Muscles that insert into the upper lip: These muscles originate from the maxilla below the infraorbital foramen and insert into the orbicularis muscle of the upper lip. The nerve supply is from the facial nerve, and these muscles act to elevate the upper lip. Along the upper vermillion–skin border, there are two medial elevations known as the philtral columns. The philtral columns form a midline depression called the philtrum and are responsible for the formation of the cupid's bow. The philtrum extends from the vermilion superiorly to the columella (Table 2).

Group 3—Muscles that insert into the lower lip: These muscles originate from the lower border of the mandible and insert into the skin of the lower lip. The nerve supply is from the facial nerve, and they act to depress the lower lip. The labiomental crease passes horizontally in an inverted U-shape across the lower lip, which intraorally corresponds to the depth of the gingivolabial sulcus; the labiomental crease can become more prominent as we age (Table 3).

FIGURE 2. Lip classification 2. Photography by Tracey Hotta. Used with permission.

FIGURE 3. Lip classification 3. Photography by Tracey Hotta. Used with permission.

INNERVATION

Cranial nerve V (trigeminal nerve) is the largest of the cranial nerves and the most important sensory nerve of the face. It branches into three divisions (Table 4): ophthalmic (V_1), maxillary (V_2), and mandibular (V_3).

The sensory innervation to the perioral region is from the maxillary and mandibular branches.

The infraorbital nerve, which is the terminal branch of the maxillary nerve, exits the infraorbital foramen approximately 4–7 mm below the orbital rim. It travels beneath the levator labii superioris and superficial to the levator anguli oris; it innervates the side of the nose, ala, columella, medial cheek, and upper lip.

Branches of the mandibular nerve innervate the lower lip and chin. One of the branches is the inferior alveolar nerve, which travels through the body of the mandible to exit at the mental foramen. This foramen is located below the second mandibular bicuspid and has 6–10 mm of lateral variability.

The infraorbital and mental nerves exit though a foramen along with its corresponding artery. To prevent complications when injecting dermal fillers, identify these nerves by putting pressure on the foramen with a fingertip, which causes a soreness or sensitive pressure point.

Cranial nerve VII (facial nerve) is the major motor nerve of the facial muscles. It divides into five prominent branches following a pattern much like the outstretched fingers placed on the side of the face. The branches from the top include temporal, zygomatic, buccal, mandibular, and cervical. The perioral muscles are innervated primarily from the buccal and mandibular branches of cranial nerve VI; they pass through the parotid gland and form multiple interconnections as the exit the parotid gland (Table 5).

THE VASCULAR PATHWAY

Injection into or occlusion of a blood vessel can be a serious complication resulting from the use of dermal fillers. Understanding the vascular structure of the face can help decrease the risk of complications. The facial artery should be considered for embolization following

TABLE 1 Group 1: Muscles That Insert Into the Modiolis

Group 1	Muscles That Insert Into the Modiolus
1. Orbicularis oris	• Purses the lips and presses them against the teeth upon contraction. • Deep orbicularis oris is responsible for the sphincter action of the lips. • Composed of long vertical segments that curl outward at the superior and inferior free margins to form a marginal protrusion. • Innervated by the buccal and mandibular branches of the facial nerve. • In the upper lip, the orbicularis oris fibers have dermal insertions approximately 4–5 mm lateral from the midline, sparing the central region. This serves to pull the skin medially at these dermal insertion points, forming the philtral columns.
2. Levator anguli oris	• Arises from the canine fossa of the maxilla beneath the infraorbital foramen. • Elevates the commissure. • Innervated by the buccal and zygomatic branches of the facial nerve. • The facial artery and the infraorbital nerve travel in a plane on the superficial surface of the muscle.
3. Zygomaticus major	• Arises from the zygomatic bone just anterior to the zygomaticotemporal suture line and passes inferiorly and medially over the buccinator and levator anguli oris to insert on the modiolus. • Superiorly, its fibers are deep to the orbicularis oculi muscle. • Inferiorly, the fibers are superficial to the facial vessels and the facial nerve. • Innervated by the zygomatic and buccal branches of the facial nerve. • Upon contraction, this muscle elevates and laterally moves the commissure.
4. Buccinator	• Arises from the posterior alveolar process of the maxilla, the ptergomandibular raphe, and the body of the mandible. • Functions to press the lips and cheek against the teeth. • Innervated by the buccal branches of the facial nerve. • The parotid duct pierces the buccinator after it crosses the anterior edge of the masseter muscle.
5. Risorius	• Arises from the parotid fascia and passes medially and anteriorly in a transverse plane to insert on the modiolus. • Innervated by the buccal branch of the facial nerve. • Upon contraction, the risorius draws the commissure laterally and produces the sardonic smile.
6. Depressor anguli oris	• Arises from the oblique line on the anterior mandible below the canine and premolar teeth. Its fibers pass superiorly and twist medially to insert on the modiolus. • Innervated by the mandibular branch of the facial nerve and enters the muscle on its deep surface. • Functions to depress and laterally move the commissure.
7. Platysma pars modiolaris	• Part of platysma that is posterolateral to the depressor anguli oris, deep to the risorius. • Along with the pars labialis, inserting into the muscles of lateral lower lip, the platysma may be a significant depressor of the lower lip.

Note. Table created by Tracey Hotta. Content adapted from www.wikipedia.org/wiki.

TABLE 2 Group 2: Muscles That Elevate the Upper Lip

Group 2	Muscles That Insert Into the Upper Lip
1. Levator labii superioris alaeque nasi	• Arises from the frontal process of the maxilla. • Fibers pass inferiorly to insert on the lateral nasal alar cartilage, the dermis of the upper lip, and the orbicularis oris muscle. • Buccal branch of the facial nerve innervates this muscle. • Upon contraction, it dilates the nostril and elevates the upper lip.
2. Levator labii superioris	• Arises from the inferior orbital rim on the maxilla, deep to the orbicularis oculi, and superior to the infraorbital foramen. • Fibers insert into the dermis of the upper lip and into the orbicularis oris. • Blood supply is from the infraorbital branch of the maxillary artery. • Innervated by the zygomatic and buccal branches of the facial nerve. • Upon contraction, the levator labii superioris elevates and everts the upper lip.
3. Zygomaticus minor	• Arises from the zygoma deep to the orbicularis oculi and just lateral to the zygomaticomaxillary suture. • Innervated by the buccal branch of the facial nerve. • Upon contraction, the zygomaticus minor elevates and pulls the commissure laterally, which contributes to the nasolabial fold.

Note. Table created by Tracey Hotta. Content adapted from www.wikipedia.org/wiki.

TABLE 3 Group 3: Muscles That Depress the Lower Lip

Group 3	Muscles That Insert Into the Lower Lip
Depressor labii inferioris	• Arises from the anterolateral mandible and medial to the insertion of the depressor anguli oris. • Lies deep to the depressor anguli oris. • Fibers pass superiorly to insert in a fan shape into the lower lip dermis and orbicularis oris. • Innervated by the mandibular branch of the facial nerve. • Acts to depress the lower lip and pull it slightly laterally.
Mentalis	• Muscle is a paired central muscle of the lower lip. • Arises from the anterior midline mandible and inserts into the dermis of the chin skin. • Insertion site of the mentalis fibers into the dermis can be observed in the pout expression. • Innervated by the mandibular branch of the facial nerve. • Acts to elevate the lower lip.
Platysma (pars labialis)	• Paired sheet of muscle in the anterior neck. • Arises from the fascia overlying the pectoralis major and deltoid muscles, and it inserts on the inferior border of the anterior mandible. • Fibers cross superiorly just before reaching the mandibular border. • Innervated by the cervical branch of the trigeminal nerve. • Blends into the muscles of expression above the angle of the lower mouth corner and lower lip; therefore, it is a lip depressor.

Note. Table created by Tracey Hotta. Content adapted from www.wikipedia.org/wiki.

TABLE 4 Cranial Nerve V

Nerve	Origin	Function
Trigeminal nerve (cranial nerve V)	It emerges from the brainstem at the level of the pons.	Three major branches innervate facial skin from chin to scalp: • Ophthalmic—Exits through the supraorbital foramen and the supratrochlear notch to provide sensory innervation to the forehead and the scalp. • Maxillary—As the nerve exits through the infraorbital foramen, it becomes the infraorbital nerve. It lays beneath the labii superioris, spreads out across the nose, lower eyelid, and upper lip, eventually intertwining with the facial nerve. • Mandibular—Innervates the muscles of mastication (motor) and inside of the cheek (sensory).
Infraorbital	Terminal branch of the maxillary nerve	Leaves the infraorbital foramen a few millimeters below and medial to the infraorbital rim, proceeds inferiorly, and then divides into its three main branches to innervate the: • ipsilateral lip, • nose, and • lower eyelid.
Mental	Terminal branch of the inferior alveolar nerve	• Emerges from the mandibular canal at mental foramen and divides beneath the depressor anguli oris muscle. • Provides sensation to the anterior aspects of the chin, lower lip, and buccal gingivae of the mandibular anterior teeth and the premolars.

Note. Table created by Tracey Hotta. Content adapted from www.wikipedia.org/wiki.

TABLE 5 Cranial Nerve VII

Nerve	Origin	Function
Facial nerve (cranial nerve VII)	It emerges from the stylomastoid foramen and passes anterolaterally through the parotid gland but does not innervate it.	Sensory and motor nerve. Innervates the muscles of facial expression; tear and saliva secretion. Located 1 cm deep and 1 cm inferior to the tragal cartilage. Five major facial branches (in parotid gland): • Temporal branch—Superficial to the zygomatic arch • Zygomatic branch—Courses toward the lateral canthus • Buccal branch—Supplies muscles of the midface • Mandibular branch—Supplies the lower lip and chin • Cervical branch—Courses into the neck Protected by the superficial lobe of the parotid gland.

Note. Table created by Tracey Hotta. Content adapted from www.wikipedia.org/wiki.

TABLE 6 Facial Vasculature

Artery	Origin/Branch
Facial artery	• Branch of the external carotid. Ascends from the neck over the mid body of the mandible just anterior to the insertion of the masseter muscle. • Branches into the: 1. mental artery, 2. inferior and superior labial artery, and 3. angular artery (courses along the nasolabial fold forming the angular artery). • Located deep to the SMAS, platysma, risorius, and zygomaticus major and minor muscles; on the undersurface of the muscle. • Superficial to buccinators and levator anguli oris. • The facial pulse is palpated where the facial artery crosses the inferior border of the mandible immediately anterior to the masseter.
Mental artery	• Branch of the facial artery that passes under the mandibular body in an anteromedial direction. • Mental artery usually has only one main perforator, which penetrates the platysma. • Mental foramen is at the level of the second premolar.
Inferior labial artery	• Branches from the facial artery—2.6 cm lateral and 1.5 cm inferior to the oral commissure. • Arises from the angle of the mouth and branches beneath the orbicularis oris.
Superior labial artery	• Branches from the facial artery—1.1 cm lateral and 0.9 cm superior to the oral commissure. • Follows the edge of the upper lip, lying between the mucous membrane and the orbicularis oris, and anastomoses with the artery on the opposite side.

Note. Table created by Tracey Hotta. Content adapted from www.wikipedia.org/wiki.

injections of the cheek, nasolabial folds, and lips. Being able to visualize the path of the facial artery will help determine where to place the needle and the depth of placement (Table 6).

The **external carotid artery** passes up the side of neck to the mandible where it divides into the left and right branches. The left branch travels under the parotid gland and passes in front of the ear as the superficial temporal artery. The right branch of the carotid passes in front of the masseter muscle and behind the depressor anguli oris muscle, through a palpable notch in the mandible. At this point, the vessel is known as the **facial artery** (Figure 4).

The **facial artery** passes forward and upward across the cheek to the angle of the mouth, where it gives rise to the **inferior labial artery** (lower lip) and the **superior labial artery** (upper lip). According to a study by Lee et al. (2015), the area where this bifurcation occurs can be seen at approximately 1.5 cm superolateral to the corner of the mouth, at a depth of approximately 3–5 mm. This can be roughly measured by placing a thumbnail beside the corner of the mouth. (Figures 5 and 6). The superior and inferior labial arteries form a circular vascular network around the mouth, with several small blood vessels branching out radially.

When performing lip augmentation, the provider not only must be aware of the location on the inferior and superior labial arteries but must also understand that these blood vessels are not always as they are in a textbook

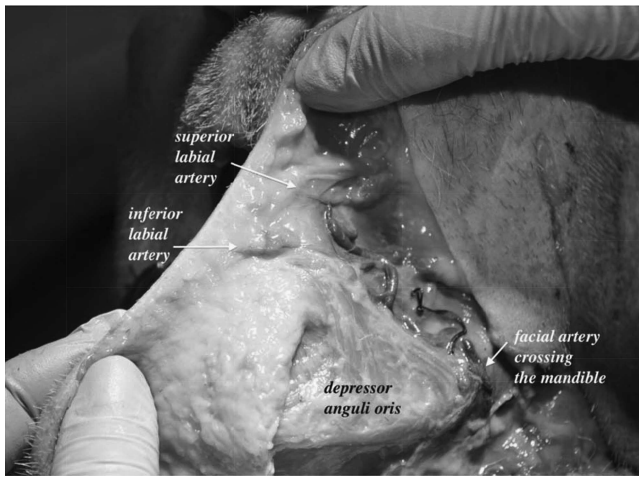

FIGURE 4. Location of the facial artery as it crosses over the mandible. Photography by Tracey Hotta.

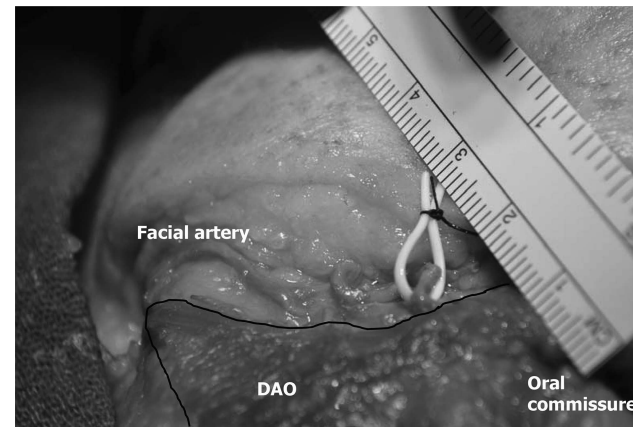

FIGURE 5. Location of the facial artery as it bifurcates into the superior and inferior labial arteries is approximately 12–15 mm from the oral commissure. Cadaver preparation by Caudio DeLorenzi. Photography by Tracey Hotta.

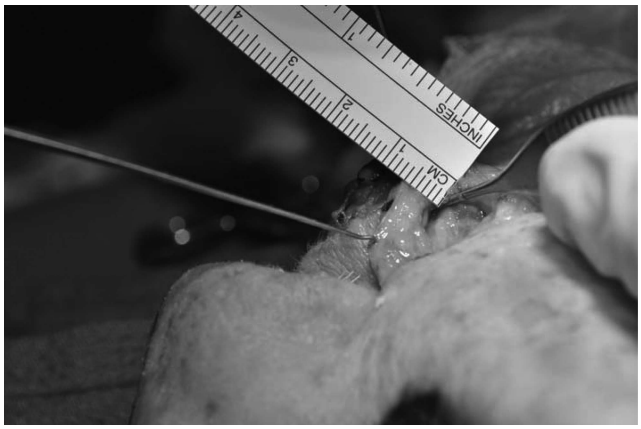

FIGURE 6. Depth of the facial/angular artery is approximately 5–6 mm. Cadaver preparation by Claudio DeLorenzi. Photography by Tracey Hotta.

FIGURE 7. Small blue dots outline the vermilion border. Large blue dots identify the wet–dry border. Cadaver preparation by Claudio DeLorenzi. Photography by Tracey Hotta.

FIGURE 8. Inferior labial artery with multiple radiating branches supplying vascularity to the lower lip. Cadaver preparation by Jack Kolenda. Photography by Tracey Hotta.

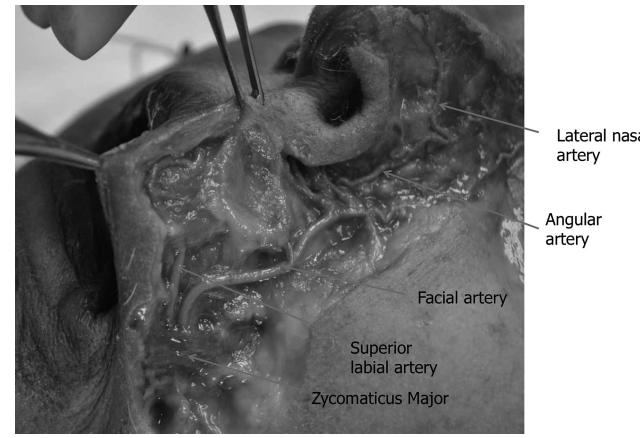

FIGURE 9. Location of the facial artery traveling under the zygomatic major muscle. Cadaver preparation by Jack Kolenda. Photography by Tracey Hotta.

illustration. Most commonly, the inferior and superior labial arteries are located posterior to the wet–dry border and under the orbicularis muscle. Injecting a dermal filler above the orbicularis oris muscle would help avoid inadvertent injection into the labial artery. However, there are branches of the labial arteries located above the orbicularis oris muscles in the area of the cupid's bow. Caution must be used when augmenting the cupid's bow, as well as constant examination of the skin for any evidence of blanching (Figures 7 and 8).

The **facial artery** then continues along the side of the mouth and across the cheek. It is located deep to the SMAS, platysma, risorius, and zygomaticus major and minor muscles but superficial to buccinators and levator anguli oris (Figure 9).

As the **facial artery** approaches the alar base of the nose, it gives off the **lateral nasal artery** that supplies

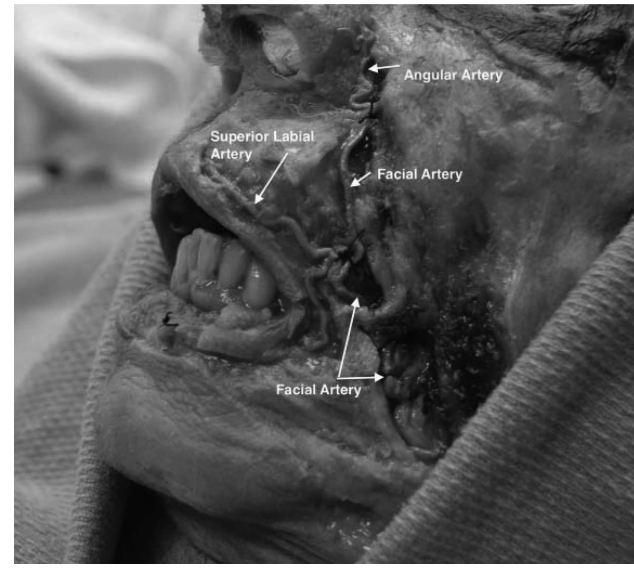

FIGURE 10. Pathway of the facial artery. Cadaver preparation by Claudio DeLorenzi. Photography by Tracey Hotta.

the ala and dorsum of the nose; at this point, the facial artery is known as the **angular artery**. The **angular artery** then ascends along the side of the nose, passes to the medial angle of the eye, and anastomoses with the nasal dorsal branch of the opthalmic artery (Figure 10).

CONCLUSION

It is imperative that health care professionals understand the importance of facial anatomy when providing treatments and educating clients for a surgical or nonsurgical procedures. Visualizing the anatomy will help prevent complications and improve patient outcomes.

Although anatomy is often considered to be a static discipline with few changes over time, new research is always coming to light that reveals new opinions regarding both gross and microanatomy. This article should be considered a snapshot in time and that updated information may come to light that may change the material contained within this article.

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