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Understanding the Anatomy of the Upper Face When Providing Aesthetic Injection Treatments

Tracey A. Hotta, BScN, RN, CPSN

Advanced rejuvenation procedures for the upper face are becoming increasingly popular for aesthetic providers but are considered a high-risk treatment area for dermal filler/contouring products. Risks may range from bruising, which is manageable, to blindness, most often irreversible. Detailed comprehension of the facial anatomy is imperative when performing aesthetic injections including neuromodulators and dermal filler/contouring products. Understanding the location and function of the muscles, as well as landmarking the blood vessels and nerves, will assist the aesthetic provider to perform safe, confident injection procedures. This article focuses on the upper face anatomy as identified by the author's cadaveric dissections and includes the treatment areas of the frontalis, temporalis, and glabellar complex. The author's next article for the *Plastic Surgical Nursing* journal will focus on the periorbital area.

THE FRONTALIS MUSCLE

The frontalis muscle is a large muscle that extends upward and laterally across the forehead. Its function is to elevate the eyebrows, usually more centrally than laterally. It is important to understand its origin and insertion points and how the frontalis is intertwined with the other periocular muscles. The origin of the frontalis is at the hairline, known as the epicranium of the aponeurosis. Its insertion is at the level of the eyebrows, where it is intertwined with the fibers of the procerus, corrugator, depressor supercilii, and orbicularis oculi muscles. The directions of the muscle fibers are vertical, which, with repeated movement, result in the appearance of horizontal lines across the forehead. The frontalis terminates laterally at the temporal fusion line, where it lies over the temporalis muscle (Figure 1).

Because the frontalis muscle is the only elevating muscle of the upper face, it is important to consider this function when using a neuromodulator in this area. The provider must assess for a functioning frontalis to determine whether a neurotoxin treatment is appropriate and will achieve the desire aesthetic result. Treating a functional frontalis may result in a heaviness of the brow or brow ptosis. The provider may choose to treat the depressive action of the glabellar complex because the muscle fibers are intertwined with the frontalis. This will result in relaxing the frontalis without actually treating it.

The blood supply to the frontalis muscle comes from the frontal branch of the superficial temporal artery, laterally, and the supratrochlear and supraorbital arteries medially.

The superficial temporal artery arises from the external carotid at the area of the mandible, travels upward approximately 1 cm in front of the ear in the preauricular space, and travels across the zygomatic arch. As it crosses the zygomatic arch, it is known as the frontal branch of the superficial temporal artery (Figure 2).

The frontal branch is the terminal branch of the superficial temporal artery and anastomoses with the supraorbital arteries within the frontalis muscle. The supratrochlear and supraorbital vessels exit through a foramen, or notch, located in the orbital rim. The supratrochlear neurovascular bundle is approximately 1.7 cm from the midline of the forehead, where the supraorbital bundle is approximately 2.7 cm from the midline (Figure 3). These blood vessels exit through the corrugator muscles and travel upward and insert into the frontalis approximately 2 cm above the orbital rim (Figure 4).

The frontalis is innervated by temporal branch of the facial nerve. The nerve originates from beneath the parotid gland and travels upward across the zygomatic arch. It is located in the loose areolar tissue just under the temporoparietal fascia. The nerve changes its plane from deep to superficial as it enters on the undersurface of the frontalis muscle at the temporal fusion line. The frontal branch of the superficial temporal artery is superior to the nerve (Figure 5).

GLABELLAR COMPLEX

Glabellar complex includes the procerus, corrugator supercilii, and the depressor supercilii muscles (Table 3). The corrugator supercilii muscle originates from the medial supraorbital ridge of the frontal bone and inserts into

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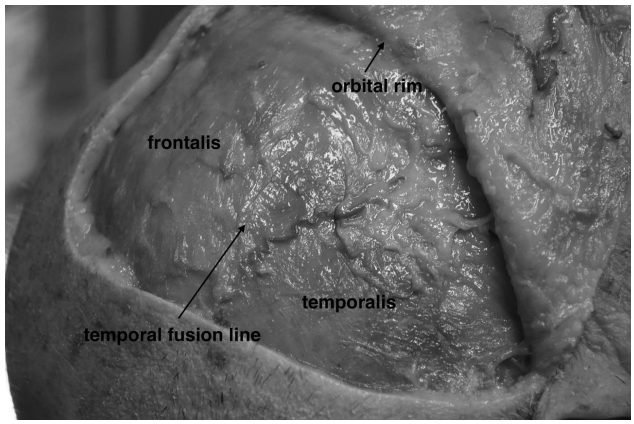

FIGURE 1. Temporal fusion line. Cadaver preparation and dissection by Tracey Hotta.

the medial eyebrow skin. The supratrochlear neurovascular bundle exits through the corrugator supercilii and supplies sensation and vascularity to the central forehead. The function of the corrugator supercilii is to cause medial brow depression.

Cadaveric dissections by Pessa and Rohrich (2012) found that the glabellar complex has distinct compartments of adipose tissue that creates the vertical lines or creases. These creases may be used as surface landmarks to identify the location of the supratrochlear artery and nerve. Contraction of the glabellar complex identifies these three distinct creases, which are the midline, corrugator, and supraorbital creases. Between these creases are fat compartments known as the medial and lateral compartments. Cadaveric studies (Pessa & Rohrich, 2012) show that the supratrochlear artery is situated within the corrugator crease and the supraorbital artery is situated within the supraorbital crease.

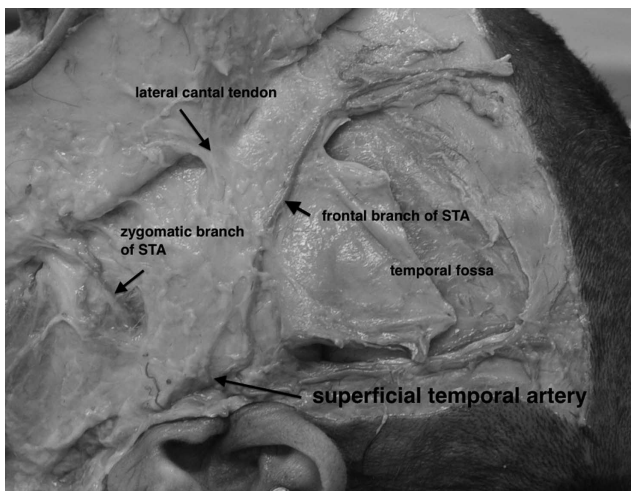

FIGURE 2. Location of the superficial temporal artery and the frontal branch of the superficial temporal artery. Cadaver preparation and dissection by Deborah Elias. STA = superficial temporal artery.

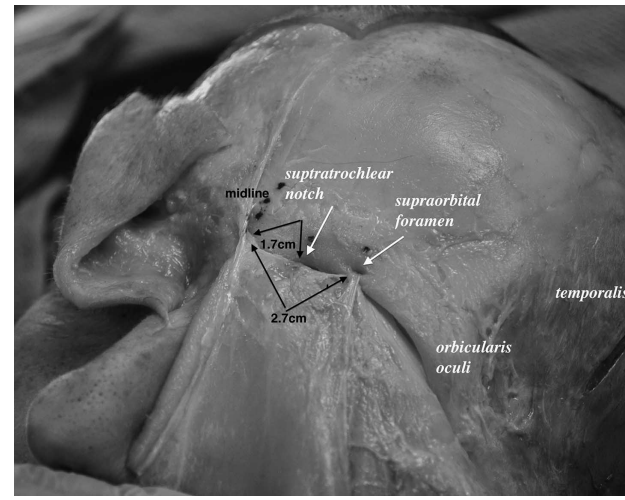

FIGURE 3. Landmarking the supratrochlear and supraorbital neurovascular bundles. Cadaver preparation by Deborah Elias and Tracey Hotta. Dissection by Claudio DeLorenzi.

The supratrochlear artery travels beneath the corrugator and frontalis muscles, with the surface landmark being the corrugator crease. As it courses upward through the frontalis muscle, the supratrochlear artery becomes more superficial and is directly beneath the skin. It is this superficial position of the central forehead vessel that may contribute to reported complication risk of injections performed in the glabellar region due to the reduced collateral blood supply.

Because the supratrochlear and supraorbital arteries are branches of the ophthalmic branch of the internal carotid artery, landmarking for the corrugator and supraorbital creases is important when a dermal filler is being used to augment these creases. Inadvertent injection into the supratrochlear artery may flow retrograde through the ophthalmic artery and lodge in the retinal artery, causing

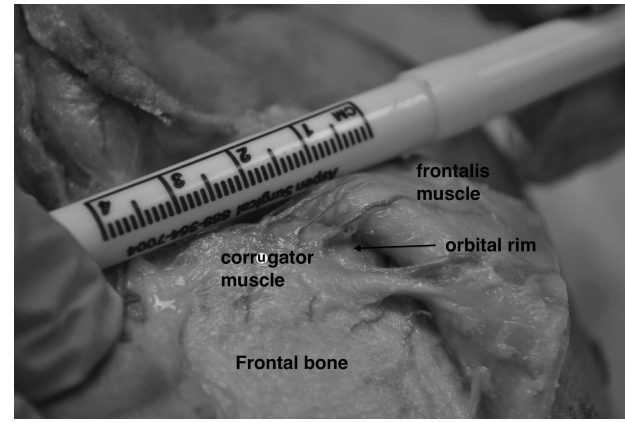

FIGURE 4. Pathway of the supratrochlear and supraorbital artery through the corrugator supercilii and into the frontalis muscle. Cadaver preparation by Deborah Elias and Tracey Hotta. Dissection by Tracey Hotta.

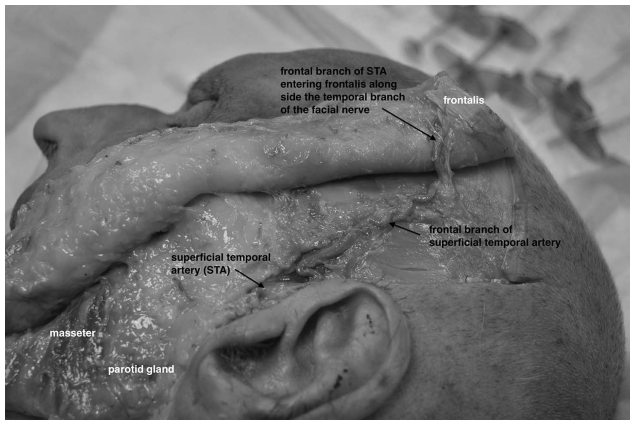

FIGURE 5. Pathway of the frontal branch of the superficial temporal artery entering the frontalis muscle at the temporal fusion line. Cadaver preparation by Tracey Hotta. Dissection by Tracey Hotta.

potential blindness. Therefore, it is recommended that an injection performed in this area should be superficial just under the dermis with a low hyaluronic acid concentration product with low injection force. This will help reduce the risk of bruising and inadvertent injury to the vessel (Figure 6).

TEMPORAL HOLLOWING

The temporalis muscle is a large fan-shaped muscle that is located at the side of the skull lateral to the orbital rim and above the zygomatic arch (Table 2). It is a muscle of mastication and is intertwined with the masseter muscle. The temporal hollow occurs from bony reabsorption, muscle atrophy, and deflation of the fat pad over the temporal area. This causes a depression at the lateral brow and may result in a skeletonized appearance (www.wikapedia.org, n.d.).

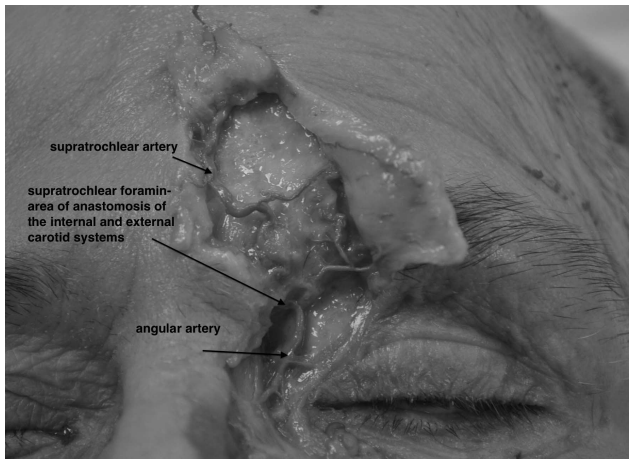

FIGURE 6. Anastomosis of the internal and external carotid systems at the junction of the supratrochlear/angular artery. Cadaver preparation by Tracey Hotta. Dissection by Tracey Hotta.

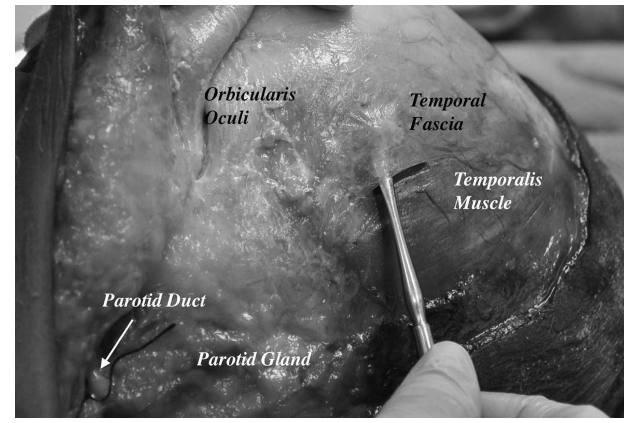

FIGURE 7. Temporal fascia. Cadaver preparation by Deborah Elias and Tracey Hotta. Dissection by Claudio DeLorenzi.

The temporal area consists of two fascial layers: deep and superficial. The deep temporal fascia is separated from the superficial fascia by an avascular plane of loose areolar tissue. It is firmly attached to periosteum around the margin of the temporalis muscle but has no attachment to the zygomatic arch. The cadaver dissection by the author revealed that the fascial layer is tight to the muscle and has very little give, especially in younger clients. This anatomy must be considered when evaluating a client for temporal augmentation (Figure 7).

With age, the muscle under the temporal fascia atrophies, allowing more space for augmentation with a contouring product. There are two injection techniques that may be used to treat temporal hollowing, and each approach carries its own risks. The provider may choose to do either a deep periosteal injection with a needle or a cannula injection into the loose areolar tissue between the two temporal fascial layers.

When considering a deep periosteal injection, the location of the deep temporal arteries must be considered. Blood is supplied to the temporalis muscle by two branches

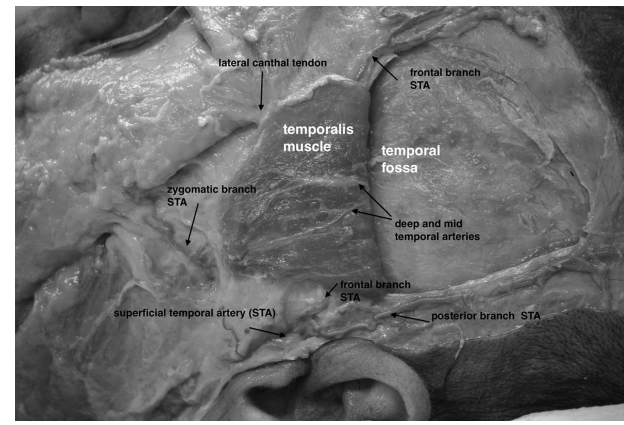

FIGURE 8. Internal structures of the temporal fossa. Cadaver preparation by Tracey Hotta. Dissection by Jack Kolenda.

of the maxillary artery, the anterior and posterior deep temporal arteries, and a branch of the external carotid, called the superficial temporary artery. In the temporal fossa, the posterior deep temporal artery moves into the temporalis muscle, along with the deep temporal nerve. The artery supplies blood to the top portion of the temporal bone and the pericranium, as well as the temporal muscle.

Landmarking for the deep temporal injection point may be done in the upper medial aspect of the temporal hollow. This area can be measured out as 1.5 cm from the lateral eyebrow and 1 cm upward. An injection in this area will be introduced into the muscle and not on the bone. Dissection of this area proved that the temporalis muscle is tightly adhered to the periosteum and requires the use of an elevator to dissect the muscle from the bone (Figure 8). Because deep temporal arteries lay within the muscle, aspiration before injecting is the recommended standard.

The second injection technique to augment the temporal hollowing is by using a needle or cannula into the subcutaneous loose areolar space between the two fascial layers (Pessa & Rohrich, 2012). The frontal branch of the superficial temporal artery and vein, along with the temporal branch of the facial nerve, is located within the superficial temporal fascia (Seckel, 2010). With proper placement, the aesthetic provider should notice the movement of the needle or cannula under the vessels. Augmenting this area may cause the blood vessels to be more visible until the product has integrated into the tissues.

CONCLUSION

Understanding the anatomical structures and surface landmarks of the muscles (Table 1), nerves (Table 2), and vessels (Table 3) will assist the aesthetic provider in performing safe and confident injection procedures of the upper face.

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TABLE 1 Muscles of the Upper Face

Muscle	Origin	Insertion	Function
Temporalis	Temporal lines on the parietal bone of the skull and the superior temporal surface of the sphenoid bone	Coronoid process of the mandible	A broad, fan-shaped muscle on each side of the head that fills the temporal fossa; functions to elevate and retract the mandible
Elevators			
Frontalis	Galea aponeurotica along the coronal suture	Dermis at the level of the eyebrows, intertwined with fibers of the procerus, corrugators, and orbicularis oculi	The sole elevator of the eyebrows
			Superficial plane
Depressors			
Procerus	Periosteum of the nasal bone	Glabellar or mid-forehead dermis	Draws the medial aspect of the eyebrows down, producing transverse lines across the nasal bridge
		The fibers are intertwined with the frontalis	Deep and superficial plane
Depressor supercilii	Nasal portion of the frontal bone ~1 cm above the medial canthal ligament	Dermis beneath the medial head of the eyebrow	Moving and depressing the eyebrow; deep plane
Corrugator supercilii	Medial supraorbital ridge of the frontal bone	A gradual interdigitating with the frontal muscle and inserting in the skin in the region of the midbrow	Adducts and slightly depresses the eyebrows
			Deep plane medially and becomes superficial as it extends laterally
Orbicularis oculi	Medial orbital margin, medial palpebral ligament; lacrimal bone	Preseptal segment—Spread over the dermis of the upper eyelid and brow	Medial and lateral brow depressor
			Superficial plane

Note. Adapted from www.wikapedia.org.

TABLE 2 Nerves of the Upper Face

Nerve	Branch	Function
Cranial nerve V	Ophthalmic branch	*Origin*—It emerges from the brainstem at the level of the pons
Trigeminal nerve		Exits through the supraorbital foramen and the supratrochlear notch to provide sensory innervation to the forehead and the scalp
		Supraorbital—Passes through the supraorbital foramen and branches into palpebral filaments to the upper eyelid
		Supplies the conjunctiva of the eye, the frontal sinus, and the skin from the forehead extending back to the middle of the scalp
		Supratrochlear—Exits the orbit between the superior oblique and the supraorbital foramen, curves up on to the forehead close to the bone, and ascends beneath the corrugator supercilii and frontalis muscles. It divides into branches through these muscles and innervates the:
		Skin of the lower part of the forehead (midline)
		Conjunctiva skin of the upper eyelid
Cranial nerve VII	Temporal branch	Emerges through the parotid gland; uppermost branch of the facial nerve; exits through the parotid gland and is superficial to the zygomatic arch
Facial nerve		Motor innervation of the frontalis muscle
	Zygomatic branch	Emerges through the parotid gland; branch of the facial nerve; exits through the parotid gland and courses toward the lateral canthus

Note. Adapted from www.wikapedia.org.

TABLE 3 Arteries of the Upper Face

Artery	Origin/Branch
Supraorbital and supratrochlear artery	Arises from the superior border of the bony orbit and courses superficially to supply blood to the forehead and scalp musculature and the overlying skin
	Supraorbital foramen is within 1 mm of medial iris and 1–1.15 cm medial to superior temporal line
Superficial temporal artery	A branch of the external carotid that supplies the lateral portion of the face and gives rise to the transverse facial artery
	It runs subdermal at the anterioinferior to the tragus and continues anteriomedially deep to the facial muscles to anastomose with branches of the supraorbital and supratrochlear vessels
	The superficial temporal pulse is palpated anterior to the auricle as the artery crosses the zygomatic arch
Deep temporal artery	The anterior and posterior deep temporal arteries ascend between the temporalis and the pericranium
	They supply the muscle and anastomose with the middle temporal artery
Dorsal nasal artery	Arises from the ophthalmic artery and is the terminal branch of the ophthalmic artery
	It emerges from the orbit above the medial palpebral ligament, supplies blood to the lacrimal sac, and then divides into two branches

Note. Adapted from www.wikapedia.org.

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