Midface Anatomy, Aging, and Aesthetic Analysis

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KEYWORDS

• Midface anatomy • Facial aging • Aesthetic analysis • Malar fat pad • Sub–orbicularis oculi fat

KEY POINTS

- The midface is the region between the upper and lower thirds of the face. Within the midface there is an anterior portion referred to as the midcheek and the posterior portion referred to as the lateral cheek.
- The changes with aging tend to affect the midcheek structures with laxity of the soft tissue supporting ligaments (orbitomalar, zygomatic, and masseteric), bony atrophy, decreases in skin thickness elasticity, and subcutaneous fat resorption.
- Goals in midface rejuvenation are to produce midcheek fullness and smooth transition into adjacent areas of the lower lid and lower face.

DEFINITION OF THE AREA

The midface is commonly used to describe the central third of the face because it is commonly divided into the upper, middle, and lower face. The upper border of the midface extends from the superior helix along the upper zygomatic arch to the lateral canthus and then along the lower lid to the nose. The lower border extends from the lower tragus to the oral commissure and along the nasolabial fold to the nose (**Fig. 1**).[1,2] The midface can further be divided by a line from the lateral canthus to the commissure. Anterior to the line is the midcheek and posterior is the lateral cheek.

The midcheek and can further be divided into lid-cheek, malar, and nasolabial components (**Fig. 2**). The palpebral malar crease separates the lower lid and malar fat divisions. The nasojugal crease separates the lower lid and nasolabial divisions. The midcheek furrow separates the malar and nasolabial divisions.[2]

With aging, the midcheek divisions become apparent with development of a nasojugal fold medially, palpebral malar groove superolaterally, and a midcheek furrow inferolaterally in the shape of a Y in between the 3 components of the midcheek (**Fig. 3**).[2,3] The youthful midcheek typically blends into the lower lid, nose, nasolabial, and lateral facial regions without demarcation and has uniform fullness and volume.[1,2]

With further anatomic study the superficial fat of the cheek itself has been shown to have 3 separate fat compartments: the medial, middle, and lateral temporal compartments, which all have separate septae.[4] In addition, the sub–orbicularis oculi fat (SOOF) located in the lid-cheek division has also been shown to have 2 separate fat compartments. The medial component of the SOOF extends from the medial limbus to the lateral canthus along the orbital rim and the lateral component extends from the medial fat pad to the temporal fat pad.[5]

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Fig. 1. The superior border of the midface lies along a line from the root of the helix to the lateral canthus to medial canthus along the side of the nose. The inferior border can be thought of as a line from the inferior border of the tragus to the lateral commissure along the nasolabial fold to the nose. The midcheek (*blue*) lies anterior to a line from the lateral canthus to commissure and posterior lies the lateral cheek (*green*).

INTERNAL ORGANIZATION/LAYERS OF THE AREA

The layers in the midface are similar to those in the upper and lower face with skin, subcutaneous fat, a musculoaponeurotic layer, loose areolar layer, and periosteum/bone (**Figs. 4** and **5**).[2]

The bony framework consists of the zygoma and the maxillary bones with a small component of the lacrimal bone.[6] Important attachments to the bony framework are the mimetic muscles, the zygomaticus major and minor, and the zygomatic ligament arising between and around the zygomaticus major and minor and minor muscles. There is limited bone available for attachment of soft tissue because the oral cavity mucosal reflexion occupies a large portion of the anterior maxilla. In addition, the prezygomatic space with the orbitomalar ligament superior and zygomatic ligaments inferiorly also limits direct soft tissue attachment to the zygomatic bone.[2] This arrangement allows gliding of the soft tissues over the spaces and

Fig. 2. The portions of the midcheek divided into lid-cheek (*blue*), nasolabial (*red*) extending into the jowl, and malar (*green*) separated by the palpebral malar crease, nasojugal crease, and midcheek furrow.

allows the separate functions of eye closure, smiling, and chewing.

In the midcheek region immediate superficial to the maxilla and zygoma lies the deep fat compartment, with preperiosteal fat and the buccal fat pad. This fat lies deep to the zygomaticus muscles and

Fig. 3. Note superomedial nasojugal folds (*blue*), superolateral palpebral malar groove (*green*), inferolateral midcheek furrow (*red*), which form the shape of a Y on anterior view.

Fig. 4. Cadaver dissection showing separation of skin, subcutaneous fat, superficial musculoaponeurotic system (SMAS), and deeper structures.

levator labii superioris, and within the fat pad are terminal branches of the zygomatic and buccal nerves that pass more superficially to innervate their muscle targets in the musculoaponeurotic layer.[7] This layer allows gliding of the mimetic muscles (zygomaticus major and minor, levator labii superioris) with facial expressions. The zygomatic nerve innervates the zygomatic muscles on their deep surface but more medially innervates the levator superioris on its superficial surface.

The superficial musculoaponeurotic system (SMAS), often credited to Mitz and Peyronie,[8] is a distinct layer in the face that is more developed in the lateral cheek region and becomes less distinct into the anterior face or midcheek region. Laterally the SMAS is more distinct separate from the parotid fascia and is continuous with the platysma inferiorly and the temporoparietal fascia superiorly.[8] The SMAS also separates fat into a superficial fat compartment that contains septae and a deeper fat compartment without septae. In the midcheek region this is analogous to the SMAS/mimetic muscle layer separating the malar fat pad from the buccal fat pad. The exact relationship of the SMAS with the parotid fascia and mimetic muscles is not clearly shown in all studies, but most studies agree that the SMAS is most distinct in the parotid region and becomes thin and less substantial moving anterior into the midcheek region.[8–11]

The subcutaneous layer in the midface includes the malar fat pad, which can be further subdivided into 3 separate compartments (medial, middle, and lateral), and each can age differently.[4] Superior and deep to the malar fat pad is the SOOF,[12] which occupies the prezygomatic space between the orbitomalar ligament and zygomatic ligament with the roof of the space being the orbicularis oculi muscle.[1,2,5] The SOOF is separate and distinct from the malar fat and adherent to the deep surface of the orbicular oculi muscle, whereas the malar fat pad is superficial to the SMAS.

Fig. 5. Relationship of the orbital fat, orbitomalar ligament (*blue*), SOOF, zygomatic ligament (*green*), and malar fat with surface bulges and creases.

SURROUNDING AREAS

The lower lid has distinct function and anatomy and can be treated in isolation or with the midface. The orbital malar ligament serves as the dividing layer with the midcheek and the lower lid structures above. In the lower lid, the layers can be separated into 3 lamellae. The anterior lamella consists of the skin and orbicularis oculi muscle, the middle lamella is the orbital septum and fat. The posterior lamella contains the tarsus, conjunctiva, and lower lid retractors.[13] The lower lid orbital fat has 3 compartments with the medial, central, and temporal fat pads (**Fig. 6**). The inferior oblique

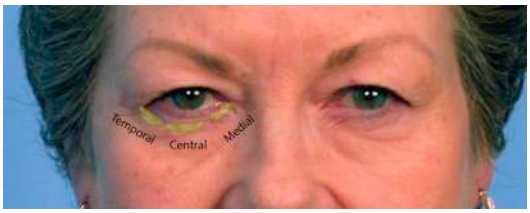

Fig. 6. The lower lid orbital fat is separated into 3 compartments: medial, central, and temporal. The inferior oblique muscle separates the medial and central compartments and can be damaged inadvertently.

muscle separates the medial and central fat pads and can inadvertently be damaged during surgery.[14]

Development of a jowl is a result of descent of cheek soft tissues from attenuation of the masseteric ligaments.[15] The described lower premasseteric space can be useful in describing the changes involved in developing a jowl. The roof of the space is the platysma and SMAS and the inferior border is a membranous connection from the SMAS layer to the mandible that anteriorly connects to the mandibular ligament. With aging, the development of laxity in SMAS, platysma, inferior border of the space, and lower masseteric ligaments allows the roof to slide and the superficial fat to descend beneath the level of the mandible, producing the jowl (**Fig. 7**).[16]

LIGAMENTS

The idea of retaining ligaments of the face or connection from bone or fascia to the dermis was proposed and demonstrated by Furnas.[17] It was further developed by Mendelson,[1] Rohrich and Pessa,[4,18] and others. The important ligaments within the midface are the zygomatic ligaments, orbitomalar ligament, and masseteric ligaments. The confluence of the 3 cheek fat compartments has commonly been described as the zygomatic ligament. In addition, the confluence of the medial and middle cheek compartments has been described as the masseteric ligaments (**Figs. 8** and **9**).[4]

Between the ligaments there is minimal attachment of the soft tissue to the underlying skeleton allowing movement and facial expression. This minimal attachment also provides an opportunity for repositioning of tissue through surgical manipulation and a safe, expeditious plane of dissection. In sub-SMAS dissection there are safe planes of dissection overlying the masseter, divided into the upper, middle, and lower premasseteric spaces, to reach the anterior space as described by Mendelson and colleagues[16] and Mendelson and Wong.[19]

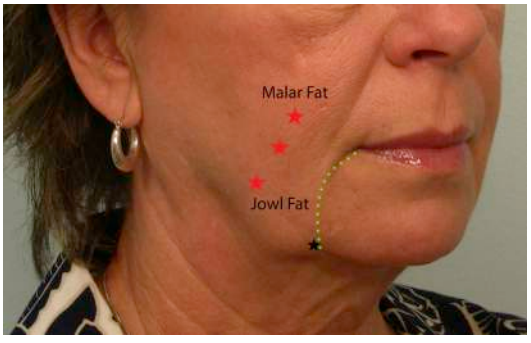

Fig. 7. Development of jowl with laxity of the roof of the premasseteric space SMAS/platysma and masseteric ligaments (*red stars*) with persistent fixation of the mandibular ligament (*black star*). The labiomandibular fold is outlined in green.

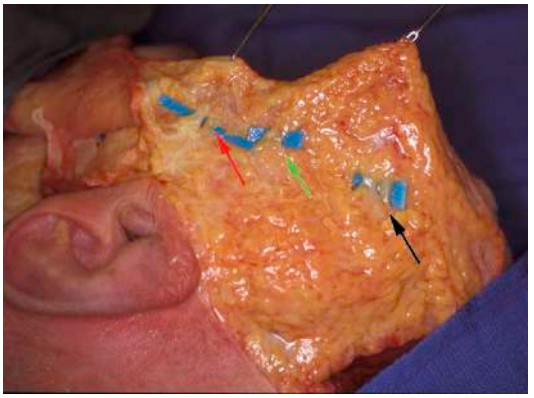

Fig. 8. Cadaver dissection showing the zygomatic ligaments (*red arrow*), the masseteric ligaments (*green arrow*), and the mandibular ligament (*black arrow*) at the anterior border of the masseter deep to the SMAS.

BLOOD SUPPLY

The blood supply to the midface arises from the external carotid artery and its branches via the facial artery and transverse facial arteries. The maxillary artery supplies the muscles and deeper

Fig. 9. Blood supply to the midface. The blood supply derives from the external carotid largely by way of the facial, maxillary, and transverse facial arteries and veins.

structures of the face via the buccal and infraorbital arteries. Venous drainage accompanies the arteries as separately named veins as well as vena comitans, and ultimately draining into the internal jugular system.[6]

The anterior portion of the midface is supplied via musculocutaneous perforators through the facial mimetic muscles arising from the facial artery system through the facial mimetic muscles. The lateral portion of the midface is typically provided via fasciocutaneous perforators from the transverse facial artery.[20,21]

LYMPHATICS

The lymphatics of the midface drain to the submental and submandibular nodes but form a rich plexus of lymphatics more dense than that of the scalp. The lymphatics begin in the subcutaneous space as lymph capillaries and drain into precollecting lymph vessels, collecting lymphatics, and then the first-tier lymph nodes. The first-tier lymph nodes are generally situated deep along the deep veins of the face and neck.[22,23]

The facial lymph nodes are the infraorbital, buccinator, and maxillary nodes, which most commonly drain to the submandibular nodes (**Fig. 10**). Disruption of the lymphatic system can lead to prolonged swelling either from direct transection or from pressure on the lymphatic system from filler materials.[24,25] Swelling can be most visible superior to the orbital malar ligament because the ligament is largely impermeable and serves as a barrier for fluid, blood, or lymph to accumulate and form festoons, malar mounds, malar edema, and periorbital ecchymosis.[23]

Fig. 10. Lymphatic system within the midface. Typically following the venous system, the important lymph nodes are the infraorbital, buccinator, and maxillary nodes, which drain to the submandibular nodes.

INNERVATION

The anatomy of the facial nerve is described in many publications but, specific to midface anatomy, the depth and location of the terminal sections of the zygomatic and buccal branches are important to understand to avoid injury. The zygomatic and buccal branches emerge from the parotid beneath the deep investing parotid fascia and travel more superficially as the nerve progresses more anteriorly.[26] The branches then lie immediately deep to the SMAS layer until innervating their muscle targets on the deep surface (zygomaticus major and minor, orbicularis oculi) and then through the SMAS layer to innervate the levator labii superioris (**Fig. 11**). Dissection

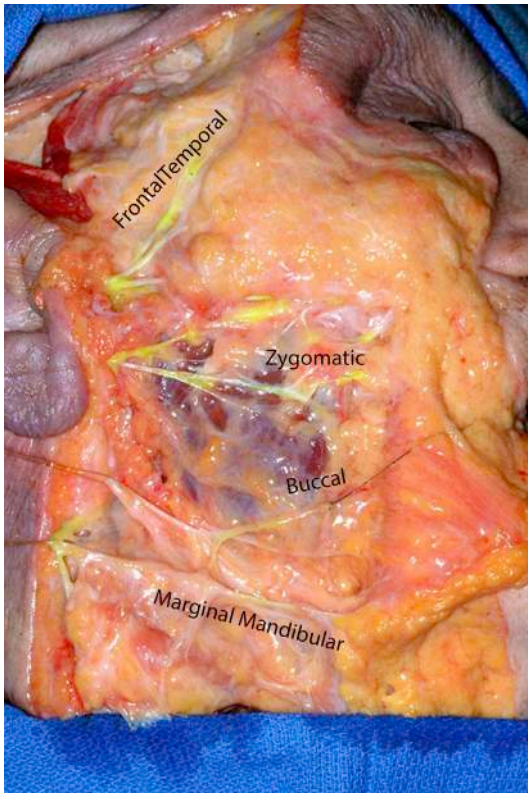

Fig. 11. The course of the extratemporal facial nerve in the face. The zygomatic and buccal branches are the important branches for midface rejuvenation.

within the subcutaneous space should be safe at all times except when overlying the levator muscles, but care must be taken with sub-SMAS dissection to avoid the zygomatic and buccal branches that traverse the sub-SMAS space. Similarly, a deeper plane of dissection also protects the facial nerve branches, as in a subperiosteal approach to the midface. In the midface in particular there are significant cross-innervations between zygomatic and buccal nerves, with about 50% cross-innervations, and damage to one branch is likely to result in no functional consequence.[27]

Sensation to the midface skin is provided mainly by branches of the infraorbital and zygomaticofacial nerves. In addition, there are minor contributions from the zygomaticotemporal nerve, infratrochlear nerve, auricular temporal nerve, and buccal nerve.[6]

SURGICAL ANATOMIC CONSIDERATIONS

The critical structure of the midface with respect to midface rejuvenation is the malar fat pad. The malar fat pad is located between the SMAS and the skin and is firmly attached to the skin.[28] The youthful position of the malar fat pad is characterized by positioning over the zygomatic arch with the superior portion covering the orbital portion of the orbicularis oculi muscle and inferior portion at the nasolabial fold with no bulging anterior to the fold.[29] With appropriate repositioning of the malar fat pad in a superior vector, the lower lid vertical distance is decreased and hollowness is eliminated in the infraorbital region.

Approaching the midface from a hairline incision can be accomplished in a subcutaneous plane and sub-SMAS plane. The subcutaneous plane is inherently safe because the branches of the facial nerve are protected by the SMAS. In a sub-SMAS plane, if the prezygomatic space is respected and properly developed, the zygomatic branch and buccal branches should be protected by the walls of the space.[19] Vascularity to the overlying skin should be robust in the same fashion as a facelift flap survives with extensive undermining.[20,21] The malar fat pad can then be resuspended in a vertical direction by the subcutaneous exposure and fixed to the temporal fascia.[28]

The midface can also be approached from periorbital approaches and even percutaneously, and all approaches are safe when the appropriate layers of dissection are respected either superficial to SMAS, subperiosteal, or in the prezygomatic spaces. A myriad of techniques for midface correction have been proposed and most can be effective and safe, and readers should refer to the literature for the details of the individual procedures.[28,30–33]

IMAGING

Computed tomography scan or plain radiographs typically have little utility in preoperative planning for rejuvenation of the midface; however, excellent standard reproducible photographs should be the goal. Close-up views of the face should be obtained with anterior, oblique, lateral, upward gaze, closed eyes, and worms-eye views. Full-face photographs should also be obtained in anterior, oblique, and lateral views. We also like to take an animation photograph with the patient smiling for midface anaylsis.[34,35]

SUMMARY

Attention to the changes within the midface is critical to achieve a harmonious facial rejuvenation. Global changes in all layers of the midface occur to produce signs of aging. The bony framework undergoes resorption with time, especially in edentulous patients.[36–42] The orbitomalar, zygomatic, and masseteric ligaments all develop laxity and allow descent of the attached soft tissues. There is also typically some loss in fat and skin thickness. Surgical correction of the midface should be directed at all layers and particular care given to blending changes into the adjacent regions of the lower lid and lower face. The anatomy, although complex because of the small spaces involved, is well described and with appropriate study surgical correction of the midface can be safe and effective.

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