



Anatomical Principles of Facial Contouring: An Integrated Review of Muscles, Fat Compartments and Vasculature

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ABSTRACT

Facial contouring is all about understanding the anatomy of the face. To get good results that are safe and look natural, you need to know about three main systems: the muscles that control facial expressions and chewing, the fat layers under the skin, and the network of blood vessels that supply these areas. This article brings together the latest research on these systems and shows how they work together. It looks at the muscles and ligaments that connect them to the skin, which is important for surgeries like facelifts and for avoiding nerve damage. The different fat compartments in the face, which were described by Rohrich and Pessa, are also discussed. These compartments change as we age, which affects how we look and can be targeted for rejuvenation treatments. The blood vessels in the face, including the main arteries, are also examined, with a focus on areas where injectable fillers can cause problems like blockages, skin death, and even blindness. By understanding how all these systems work together, doctors can do a better job with treatments like Botox, fat transfers, fillers, and surgical facelifts. The key to successful facial contouring is having a good understanding of the anatomy of the face, rather than just focusing on specific techniques. This approach helps doctors make informed decisions and avoid complications, leading to better, more natural-looking results. For example, knowing how the muscles, fat, and blood vessels are arranged can help clinicians choose the right treatment for each patient and avoid areas that are at risk of complications. By taking a step back and looking at the whole picture, rather than just focusing on one area or technique, doctors can provide safer and more effective care. In the end, facial contouring is not just about fixing one problem area, but about understanding how all the different parts of the face work together to create a natural, harmonious look. By taking the time to understand the anatomy and how it changes over time, clinicians can help patients achieve the results they want, whether that is through surgery, injectable, or other treatments.

Keywords: facial anatomy, facial fat compartments, superficial musculoaponeurotic system, facial vasculature, danger zones, facial contouring

INTRODUCTION

Facial contouring encompasses the full spectrum of minimally invasive and surgical interventions used to modify facial shape, volume and dynamic expression, ranging from botulinum neuromodulation and dermal filler augmentation to structural fat grafting and rhytidectomy [1,2]. The explosive global growth of these procedures over the past two decades has been matched by an equally rapid expansion of the anatomical literature describing the layered soft-tissue architecture of the face [3,4]. Where earlier surgical teaching regarded the subcutaneous face as a single confluent mass of fat overlying a continuous muscular sheet, contemporary anatomical dissection has demonstrated a highly organised, three-dimensional system of discrete muscular units, septally bound fat compartments and predictable neurovascular pathways [3,5]. This compartmentalisation has practical consequences. Aesthetic outcomes and, more importantly, patient safety are dictated not by the volume of product injected or tissue resected, but by the plane and compartment in which an intervention is performed relative to the muscular, adipose and vascular layers of the face [6,7]. Complications such as intravascular filler embolisation, blindness, skin necrosis and iatrogenic nerve palsy all arise from a failure to respect this layered anatomy [8,9,10]. When we think about the face, we often focus on individual parts, like the muscles, fat, and blood vessels. But what if we could bring all these elements together to get a better understanding of how they work as a whole? That's exactly what this review is trying to do. By combining the muscular and fascial structure of the face, the different layers of fat, and the network of arteries and veins, we can create a more complete picture of how the face is put together. This can help clinicians and surgeons get a better grasp of how to safely and effectively change the shape of the face, whether it's to fix a problem or improve someone's appearance.

Objectives

To synthesise the anatomical literature on the SMAS, facial fat compartments and facial vasculature into an integrated framework, demonstrating how a layered, vessel-aware approach improves the safety of facial contouring procedures.

METHODOLOGY

This study was conducted as an integrative review of the literature to synthesize anatomical evidence on the muscles, facial fat compartments, and vasculature involved in facial contouring. A comprehensive literature search was performed in PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar using combinations of keywords related to facial contouring, facial muscles, fat compartments, facial artery, facial vasculature, SMAS, and facial anatomy. Relevant English-language studies, including cadaveric, imaging, morphometric, anatomical, and clinical-anatomical studies, were considered. Duplicate records were removed, followed by title/abstract screening and full-text assessment according to predefined inclusion and exclusion criteria. Relevant data regarding anatomical structures, spatial relationships, anatomical variations, and clinical relevance were extracted and critically evaluated. The findings were synthesized thematically under three principal domains—facial musculature, fat compartments, and vasculature—and subsequently integrated to establish their anatomical relationships and implications for facial contouring.

Musculature and Fascial Architecture of the Face

The Superficial Musculo Aponeurotic System (SMAS)

The superficial musculo aponeurotic system (SMAS) was first formally described by Mitz and Peyronie [11] as a continuous fibromuscular layer investing the platysma and the superficial mimetic muscles of the cheek and parotid region. The SMAS is now understood as a fascial continuum: it thickens over the parotid gland, thins medially over the cheek, continues superiorly as the temporoparietal (superficial temporal) fascia above the zygomatic arch, and becomes continuous inferiorly with the platysma of the neck [12,13]. Functionally, the SMAS transmits the contractile force of the underlying mimetic muscles to the overlying dermis via fine fibrous septa, allowing coordinated, skin-deep facial movement rather than isolated muscle bulging [13,5]. The clinical significance of the SMAS is twofold. First, it constitutes the principal load-bearing structure exploited in rhytidectomy: SMAS plication, imbrication or deep-plane elevation allows vector-specific repositioning of ptotic soft tissue without excessive tension on the overlying skin [12]. Second, the SMAS divides the face into

superficial and deep fat compartments, a partition that is central to the compartmental theory of facial ageing [3,2].

Retaining Ligaments of the Face

The face is held in place by a network of ligaments that connect the skin and underlying tissue to the bones and deeper structures. These ligaments, including the zygomatic, masseteric, and mandibular ligaments, act like anchors to keep everything in its proper position [14]. They also help to divide the space under the skin into separate compartments, which helps to prevent the tissue from sagging downward due to gravity when we're young. As we age, these ligaments start to loosen, which allows the fat in the cheeks to droop and the jowls to form [15]. This process is more about the ligaments weakening than the skin and tissue stretching out. The ligaments are also important during surgery because they help guide the surgeon to the right planes of dissection, and they're closely related to the branches of the facial nerve, which must be preserved to maintain normal facial function [14,16]. By understanding the role of these ligaments, surgeons can use them as landmarks to safely release the tissue and restore a more youthful appearance during a facelift.

Mimetic Musculature

The muscles of facial expression, or mimetic muscles, are a group of approximately thirty flat, subcutaneous muscles per hemiface that originate from bone or fascia and insert directly into the dermis, distinguishing them from typical skeletal muscle [13,4]. They are conventionally grouped by function and location into the periorbital group (orbicularis oculi, corrugator supercilii, procerus), the nasal group, and the perioral or buccolabial group, which includes the zygomaticus major and minor, levator labii superioris, levator anguli oris, depressor anguli oris, depressor labii inferioris, mentalis, risorius and orbicularis oris [13]. All mimetic muscles are innervated by the facial nerve (cranial nerve VII) and vascularised principally by branches of the facial artery, an anatomical pairing that is of direct relevance when planning injection depth for neuromodulators [13,17].

There's a lot of variation in the muscles of the face, which can affect how a person's smile looks. For instance, the zygomaticus major and minor muscles can be different from one person to another, with varying sizes, insertion points, and connections to surrounding tissues. This variability is important to consider when doing cosmetic procedures, like Botox or facial fillers, because it can impact the symmetry and quality of the smile. Similar variations have been found in other facial muscles, like the depressor anguli oris and platysma, highlighting the need for personalized assessments before treatment, rather than relying on a one-size-fits-all approach.

The Masseter and Lower Facial Contour

When it comes to the muscles in our face, there's one that plays a big role in shaping our jawline and the width of our lower face - the masseter muscle. This muscle helps us chew and is controlled by a nerve called the trigeminal nerve. If the masseter muscle becomes too big, either because of grinding our teeth, genetics, or some other reason, it can make our jawline look square and wide, which some people don't find very attractive, especially in women [17]. To fix this, doctors have started using a special kind of treatment that involves injecting a medicine called botulinum into the masseter muscle [18]. This helps to narrow the lower part of the face and make the jawline look softer. Before doing the treatment, doctors usually try to figure out how big and thick the muscle is, so they can decide on the best way to do the injection [17,18]. It's really important for the doctor to be very careful when injecting the medicine, because there are some important nerves and blood vessels near the masseter muscle that could get damaged if the injection isn't done just right. Effective localization of injection points in the inferior masseteric region is critical due to the close proximity of the marginal mandibular branch of the facial nerve and the facial artery. Accurate identification of bony landmarks is necessary to prevent accidental nerve damage or vascular complications [19].

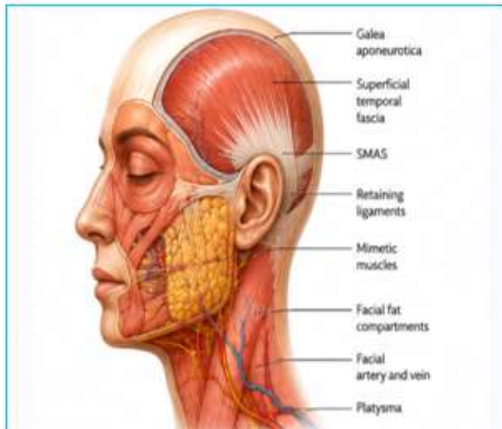


Figure 1. Facial Soft-Tissue Layers and Musculofascial Architecture

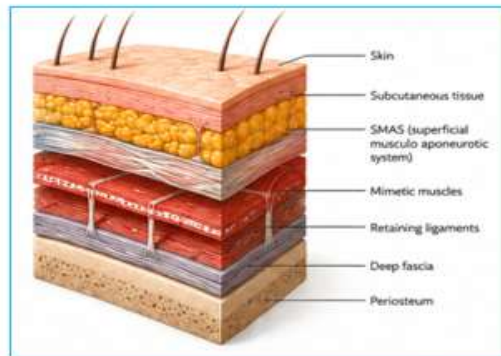


Figure 2. Layered Anatomy of the SMAS and Deep Facial Tissues

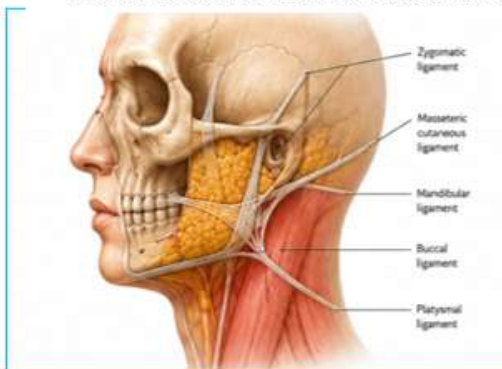


Figure 3. Retaining Ligaments of the

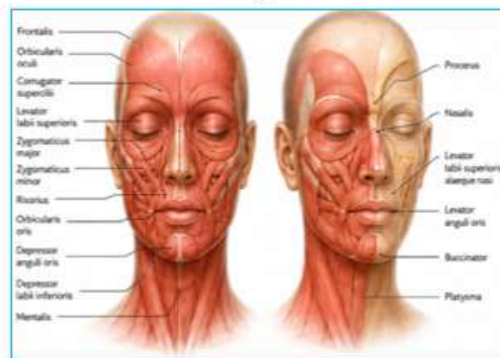


Figure 4. Mimetic Musculature of the

Facial Fat Compartments

The Compartmental Theory of Facial Fat

For a long time, people thought that facial aging happened because of gravity, and that the fat under our skin was just one big lump that moved down as we got older. But then Rohrich and Pessa came along and changed our understanding of this. They used a special technique where they injected dye into dead bodies to study the fat under the skin [3]. What they found was that the fat in our face is actually divided into separate compartments, like little pockets, that are kept apart by thin walls of fiber. They identified different areas of fat in the face, like the ones in the temples and cheeks, and even found a special area of fat around the nose and mouth that had its own boundaries [3]. This was a big discovery, and it helped us understand that the fat in our face is more complex than we thought.

The idea of separating the face into different parts has now been applied to the deeper layers of the face. Researchers Rohrich, Pessa, and Ristow identified a specific area of fat in the cheek, describing the deep medial cheek fat compartment together with the sub-orbicularis oculi fat (SOOF) and submental fat, and introduced the concept of "pseudoptosis" [20]. This is when the loss of volume in the deeper fat layers makes the outer layers of skin and fat appear to be sagging, even if they're actually still in place. This can make the folds between the nose and mouth look deeper, without any actual weakening of the ligaments or sagging due to gravity [20,21]. It's an important distinction, because it means that there are two different types of sagging: one where the tissue actually descends due to weakened ligaments, and another where it just appears to be sagging due to loss of volume in the deeper layers. This difference is crucial for figuring out the best way to rejuvenate the face - whether to lift the skin or add volume to the deeper layers.

Superficial versus Deep Compartments and the Retaining Septa

The layers of tissue that separate different areas of fat in the face come from a thick layer of tissue called the SMAS. These layers are similar to the strong threads that hold the face in place, but they are not exactly the

same. The fat areas that are close to the surface of the skin, like the ones around the nose and mouth, the middle and outer cheeks, and the jawline, are located above the SMAS [14,3]. As we get older, these areas of fat tend to move down and change shape within their boundaries, rather than just shrinking away. On the other hand, the deeper areas of fat, like the ones in the inner cheek and around the eyes, are located underneath the muscles of the face and are more likely to actually shrink and lose volume over time. Computed tomographic and three-dimensional imaging studies have corroborated and quantified these histologically defined boundaries in living subjects, confirming compartment-specific volumetric change with age, including selective enlargement of some superficial compartments alongside atrophy of adjacent deep compartments [22]. Bony remodelling compounds these soft-tissue changes: resorption at the pyriform aperture, inferolateral orbital rim and prejowl mandible reduces the skeletal foundation upon which the fat compartments rest, further accentuating the clinical appearance of midfacial and jawline ageing [23,24,25,26].

The Temporal and Buccal Fat Pads

There are two types of fat deposits that are worth mentioning because of their unique structure and importance in shaping the face. In the temple area, there's a special layer of fat that's nestled between two layers of tissue. This fat pad is called the temporal fat pad, and it's located about two to three centimeters above the cheekbone [27]. There's also another layer of fat that's closer to the surface, situated between two layers of tissue in the temple area. As we age or if we injure this area, we can lose volume in these layers, which can cause the temple to look hollow [28]. To fix this, doctors often use a technique called structural fat grafting or filler placement, where they target the correct layer of tissue to restore the lost volume and improve the contour of the face.

The buccal fat pad is a special kind of fat that helps protect the important parts of our face, like the nerves and glands, when we eat. It's located between two muscles in our face, and it also extends into other areas like the temple and the area behind our jaw. This fat pad is different from other fat in our face, and it plays a crucial role in keeping our face safe while we chew. Sometimes, doctors will remove some of this fat to make the lower part of the face look less round, but they have to be very careful because the fat pad is close to important nerves and ducts. They need to use a precise and layered approach to avoid damaging these sensitive areas. The buccal fat pad, identified by Bichat and also known as the corpus adiposum buccae, is a distinct encapsulated mass of adipose tissue. It is located between the buccinator and masseter muscles, extending into the temporal, pterygoid, and pterygopalatine regions [29,30].

Clinical Implications of the Compartmental Model

The way we think about facial rejuvenation has changed with the compartmental model. Now, instead of just adding volume all over the face, we focus on specific areas that need it. The "lift-and-fill" facelift is a good example of this. It uses knowledge of the fat compartments in the face to lift and fill in the right places. This means that instead of just cutting out excess skin, the surgeon can reposition the skin and add volume to the deep compartments that have lost fat over time [31]. This approach is similar to structural fat grafting, which involves taking fat from one part of the body and injecting it into another area to restore volume. This technique was first developed by Coleman and has since been improved by many other experts [32,33]. The key to making it work is to place the fat in the right compartments, using a multi-plane approach to get a natural-looking result. This helps to avoid problems like contour irregularities and fat necrosis, which can happen when the fat doesn't survive in its new location [34,35,36,37,28]. By being more targeted and careful in our approach, we can get more durable and natural-looking results from facial rejuvenation.

Vasculature of the Face and Danger Zones

The Facial Artery and Its Course

The main blood supply to the front of the face comes from the facial artery, which is a branch of the external carotid artery. This artery is often involved in complications related to facial fillers [7,38]. It crosses the bottom of the jawbone, in front of the masseter muscle, and then goes up across the cheek at an angle. The facial artery usually ends as the angular artery, near the inner corner of the eye, where it connects with another artery called the dorsal nasal branch of the ophthalmic artery [8,39]. This connection is very important for understanding how

filler injections can cause blindness. Studies using cadavers have mapped out the path of the facial artery in relation to noticeable landmarks on the face, such as the corner of the mouth, the edge of the nose, and the border of the masseter muscle [7,38,40]. This information helps guide safer injection practices when getting fillers in areas like the nasolabial fold, the buccal area, and the jawline.

By knowing exactly where the facial artery is in relation to these landmarks, doctors can reduce the risk of complications when injecting fillers. For example, the facial artery's path near the oral commissure, or the corner of the mouth, is an important area to avoid when injecting fillers. Similarly, the artery's location near the nasal ala, or the edge of the nose, and the masseteric border, or the edge of the masseter muscle, must be carefully considered to prevent accidents. By understanding the anatomy of the facial artery and its relationship to these soft-tissue landmarks, doctors can provide safer and more effective filler injections. There's a lot of variation in how the facial artery is structured, including how deep it is, how it branches out, and even whether it's more prominent than the facial vein. This variation is really important to consider when it comes to patient safety, because it means you can't assume a standard "safe zone" for every person - what works for one patient might not work for another [7,39].

The Infraorbital and Superficial Temporal Arteries

The infraorbital artery, a terminal branch of the maxillary artery, emerges through the infraorbital foramen and anastomoses extensively with the facial, angular and ophthalmic vessels, creating a further high-risk zone for vascular compromise during midfacial filler injection [41]. Cadaveric dissection has defined specific danger zones within the infraorbital region where these anastomoses are most concentrated and where retrograde embolisation towards the ophthalmic circulation is most likely to occur [41]. In the temple area, there's a key artery that runs close to the surface, near a vein and a nerve. This artery is called the frontal branch of the superficial temporal artery. It's located just above a layer of tissue called the deep temporal fascia. Below this layer, there are other blood vessels that supply fat pads in the temple. When injecting fillers or other substances into this area, doctors need to be very careful. If they inject too close to the surface, they risk damaging the artery. But if they go too deep, they might hurt the nerve that controls facial movements. This shows how important it is for doctors to have a precise technique when working in the temple area, to avoid damaging important blood vessels and nerves.

Recognised Vascular Danger Zones

Building on the detailed understanding of facial vascular anatomy, several authors have developed practical maps of facial "danger zones" to help guide soft-tissue filler injections. These maps bring together high-risk areas such as the glabella, nasal dorsum, nasolabial fold, infraorbital region, temple, lips, and chin, providing clinicians with a simple and practical framework for safer injection practices [6,42]. These danger zones correspond closely to regions where the external carotid arterial territory anastomoses with the internal carotid (ophthalmic) territory, since it is retrograde embolisation through such anastomoses—rather than local vessel occlusion alone—that produces the most feared complication of filler injection, namely retinal or cerebral ischaemia [10,42]. When something goes terribly wrong with an injection into an artery, the results can be devastating. People can experience skin death, permanent blindness in one eye, and in rare cases, even a stroke or brain damage. Sadly, most people who go blind from this don't get their sight back, even with treatment. This shows just how important it is for doctors to know the exact path and connections of the arteries, rather than just focusing on how much to inject or the properties of the product being used. This knowledge is key to preventing terrible complications when trying to change the shape of someone's face.

The Facial Nerve as a Co-located Structure

The facial nerve plays a crucial role in facial contouring, even though it's not directly related to blood vessels. This is because its branches are closely tied to the vessels and the SMAS, a layer of tissue that's important for facial structure [16,19]. The frontal and marginal mandibular branches are especially important, as they control muscles that don't have backup innervation. This means that even small injuries to these branches can cause noticeable and long-lasting problems, such as droopy eyebrows or uneven lips. The way the facial nerve travels through the face is also important for safety. It goes deep beneath the SMAS in the middle and lower parts of

the face, before becoming more superficial near the muscles it targets [12,16]. This means that the plane of dissection or injection, relative to the SMAS, is just as important as the exact location of the injection. In other words, it's not just about where you inject, but also how deep you go.

Understanding the anatomy of the facial nerve is vital for safe and effective facial contouring. By being mindful of the nerve's location and its relationship to the surrounding tissue, practitioners can minimize the risk of injury and ensure the best possible outcomes for their patients. This is especially important when working with the frontal and marginal mandibular branches, as damage to these areas can have significant and lasting effects on facial appearance and function [16,19].

Overall, the facial nerve is a critical consideration in facial contouring, and its unique anatomy demands careful attention and precision to avoid complications and ensure optimal results. By taking the time to understand the nerve's anatomy and its relationship to the surrounding tissue, practitioners can provide safer and more effective treatments for their patients.

Integrated Clinical Correlations

When we think about the face, we tend to break it down into different parts - the muscles, the fat, and the blood vessels. But in reality, these parts are all connected and work together as one unit. The SMAS, a layer of tissue, surrounds the muscles that help us make facial expressions, separates the fat into different layers, and provides a path for the major blood vessels and nerves to follow [2,3,12]. So, when a doctor is deciding how deep to inject something or a surgeon is figuring out the best way to make an incision, they're making a decision that affects all three of these systems at the same time. This means that understanding how these systems work together is crucial for getting the best results. When it comes to treating the face, it's crucial to have a comprehensive understanding of the underlying structures. For instance, in neuromodulator therapy, doctors need to carefully target the muscles of the face, taking into account the path of the facial artery and its branches. This is to avoid potential complications like hematoma or, in rare cases, vascular compromise. Similarly, when using fillers to augment the face, it's essential to place them in specific compartments. For example, injecting fillers deep into the medial cheek fat, rather than just superficially, can help maximize the aesthetic benefits while minimizing the risk of injecting into a blood vessel. This approach can help reduce the risk of intravascular injection, which can have serious consequences.

In fat grafting, a similar logic applies. By depositing graft material in multiple thin layers within a defined plane, rather than as a single large bolus, doctors can reduce the risk of vascular embolization and fat necrosis. This approach also tends to improve the take of the graft, leading to more effective and longer-lasting results. Even in surgical procedures like facelifts, a thorough understanding of the facial anatomy is vital. The retaining ligaments of the face provide reliable landmarks that help surgeons avoid the facial nerve during the procedure. Meanwhile, the boundaries of the fat compartments determine the safest and most effective way to reposition soft tissue, ensuring a more natural-looking result. By taking a meticulous and compartment-focused approach, doctors can achieve better outcomes and minimize the risk of complications.

Taken together, these examples support a broader methodological point for the field: procedural innovation in facial contouring has consistently followed, rather than preceded, advances in the anatomical description of the face. The shift from confluent-fat to compartmental models of ageing reshaped volumetric practice [3,43]; the delineation of arterial danger zones reshaped filler safety protocols [6,44]; and the clarification of SMAS-ligament-nerve relationships reshaped facelift technique [12]. Continued refinement of facial contouring practice is therefore likely to depend on further anatomical study, particularly regarding population-specific variation in compartment volume, vascular course and ligamentous strength, which remains comparatively underexplored relative to the classical Western cadaveric literature on which much current teaching is based [7,17].

Limitations and Anatomical Variability

The review discusses the anatomical framework of facial contouring literature, particularly emphasizing the reliance on cadaveric dissection. It points out the limitations of this approach, noting that studies on the facial artery, SMAS, and retaining ligaments often analyze a small number of hemifaces from few donors, leading to

potential distortion in what is deemed "typical" due to individual anatomical variations [7,39]. The classical papers in medical education primarily utilized donor pools from elderly, embalmed individuals in predominantly Western body-donor programs. This demographic and geographic bias is often not acknowledged when applying these findings to a global patient population. [7,17]. Embalming limits tissue examination by focusing on a static point in aging with zero perfusion pressure, which overlooks the dynamic alterations in vessel calibration, position, and flow that happen during live injections due to facial movement and vasodilation from local anaesthesia. [7].

These constraints highlight significant anatomical variation in populations, as evidenced by a study of 300 facial arteries in Asian patients. The study found that the facial artery typically ends as the lateral nasal or inferior alar artery (54.3%), differing from historical Western cadaveric descriptions. It also showed that the vertical distance from the facial artery to the inner canthus varies based on arterial termination patterns, indicating that a universal "safe distance" cannot be applied across patients [45]. Age influences fat compartments, showing enlargement in some superficial areas and atrophy in deep ones via volumetric CT studies. This compartment-specific pattern highlights the inadequacies of traditional cadaveric dissection methods. Findings suggest that danger zones and compartment boundaries are approximations that vary with ethnicity and age, factors not fully addressed in current medical education regarding injection safety [22].

Ultrasound-Guided Vascular-Safe Injections

A high-frequency ultrasound enhances injectable practice by providing patient-specific information about facial or angular arteries, improving upon traditional cadaveric danger-zone maps that are generalized for populations. This technology enables clinicians to visualize artery depth, calibre, and course prior to needle or cannula insertion, making the approach more precise and personalized [46,47]. Pre-procedural scanning is advocated to adjust injection points away from superficial or misaligned vessels, particularly in high-risk areas like the glabella, temple, and nasolabial fold, due to significant anatomical variability and severe consequences of intravascular injections [46,48].

Real-time ultrasound guidance allows for direct visualization of the needle or cannula tip in relation to the target vessel during injections, confirming proper placement of filler material more effectively than aspiration alone [47]. High-frequency linear probes (18 MHz and above) allow for accurate resolution of the labial, angular, and superficial temporal vessels, differentiating them from nearby fat and muscle. Recent structured scanning protocols for facial subunits aim to standardize this method among practitioners [48]. Ultrasound guidance has limitations such as the requirement for additional equipment, specialized psychomotor skills, operator-dependent image interpretation, and a two-dimensional output that may not accurately depict small-calibre or deeply coursing vessels [46,47]. Recent evidence suggests that ultrasound should be incorporated into the assessment of patients in danger zones during treatment, rather than solely relying on surface landmarks.

Table 1. Fat compartment-specific ageing change and the corresponding indicated treatment strategy

Fat Compartment	Characteristic Age-Related Change	Indicated Treatment Strategy
Deep medial cheek fat (incl. SOOF)	Progressive volumetric atrophy producing pseudoptosis of the overlying superficial fat rather than true descent	Deep, supraperiosteal volume restoration (filler or structural fat grafting) targeted to the deficient compartment rather than superficial lifting [20,21]
Superficial nasolabial/malar fat	Descent and shape change within an intact compartment boundary rather than shrinkage	Repositioning-based approaches (SMAS elevation/facelift) more directly address descent than volume addition alone [3,14]
Temporal fat pads (superficial & deep)	Volume loss creating temporal tunnelling	Implanting the structural fat or filler retained in the right sub-fascial plane [27,28]
Buccal fat pad	Relatively stable in youth; reduction sought electively for lower-face width	Judicious partial excision via an intraoral approach, preserving duct and nerve relations [29,30]

Periorbital/SOOF and infraorbital fat	Atrophy contributing to tear-trough deformity	Conservative, supraperiosteal filler placement respecting the infraorbital artery danger zone [41,20]
Jowl/superficial jaw-line fat	Descent with overlying ligament laxity	Combined ligament release and repositioning (facelift) rather than volume addition alone [14,15]

Table 2. Key facial vascular danger zones with recommended injection depths and techniques.

Danger Zone	Vessel(s) at Risk	Recommended Plane/Depth	Technique & Precautions
Glabella	Supra trochlear & supraorbital arteries; anastomoses with the ophthalmic system	Supra periosteal or superficial sub-dermal	Cannula preferred where feasible; slow, low-volume technique with frequent redirection; avoid deep bolus [6,42]
Nasal dorsum/tip	Dorsal nasal artery; terminal branches of the facial artery	Supra perichondrial/supraperiosteal, strictly midline	Small aliquots, frequent redirection, immediate cessation if blanching occurs [8,9,42]
Nasolabial fold	Facial artery (medial to the fold in the majority of patients)	Deep, supra periosteal; lateral to the artery's expected course	Cannula preferred; awareness that the facial artery lies medial to the fold in the majority of patients [7,40,45]
Infraorbital/tear trough	Infra orbital artery; anastomoses with facial and angular vessels	Deep, supraperiosteal, immediately on bone	Small volumes, blunt cannula, avoid superficial placement [41]
Temple	Frontal branch of the superficial temporal artery; sentinel vein	Immediately above the deep temporal fascia, or within the sub-superficial-temporal fascial plane	Identify the correct fascial plane before injecting; avoid superficial placement near the vessel [27]
Lips/perioral	Superior and inferior labial arteries	Sub-mucosal or sub-dermal, away from vermilion-border vasculature	Slow, low-pressure technique with frequent aspiration and small aliquots [38]
Chin/jawline	Facial artery at the mandibular border; mental artery	Supra periosteal	Cannula preferred; awareness that the artery crosses the mandible at a relatively constant point anterior to masseter [7,38]

DISCUSSION

This study brings together important information about a part of the body that hasn't been well understood until now. The main point - that changing the shape of the face safely and effectively requires a deep understanding of how muscles, fat, and blood vessels work together - makes sense and is supported by evidence. The idea of looking at these three layers together provides a clear and useful way to think about the face, which is helpful for both teaching and medical practice. The authors are right to say that the techniques used to change the shape of the face should be based on a solid understanding of how the face is put together, rather than just being developed on their own. By taking this approach, doctors can make more informed decisions and get better results. Nonetheless, certain limitations warrant consideration. The review draws almost exclusively on cadaveric dissection studies, a number of which are several decades old and based on comparatively small, predominantly Western sample populations. Although this limitation is acknowledged in the concluding section, the acknowledgement appears somewhat perfunctory given the extent to which the argument depends on this body of evidence throughout. Furthermore, there is minimal engagement with dynamic, in-vivo imaging or with clinical outcome data, meaning the review functions primarily as an anatomical synthesis rather than as an evaluation of how these principles translate into demonstrable improvements in patient safety. The treatment of vascular danger zones, while comprehensive, does not fully reconcile the tension between the concept of fixed

anatomical danger zones and the paper's own repeated acknowledgement of substantial inter-individual vascular variability. This raises questions about the practical reliability of static anatomical maps as a safety tool. This review provides a good starting point for understanding the concept, but it doesn't offer a complete guide for clinical practice. To make it more useful, it would be helpful to include more information about how people's bodies can vary and what the actual results have been in similar situations. This would make the review more thorough and reliable in the future.

CONCLUSION

Facial contouring, across its full range of surgical and non-surgical modalities, is an anatomically driven discipline. The superficial musculoaponeurotic system and its retaining ligaments provide the structural chassis linking mimetic muscle to skin and delineate the boundaries of the fat compartments; the compartmentalised superficial and deep fat of the face determines the pattern of volumetric change with age and the appropriate target for augmentation; and the facial, infraorbital and superficial temporal arteries, together with their anastomotic connections to the orbital and intracranial circulations, define the principal safety constraints on any facial intervention. No single one of these systems can be considered in isolation without risking suboptimal aesthetic outcomes or, more seriously, avoidable vascular and neural complications. A tri-layer, anatomically integrated model—rather than a purely procedural or product-centred approach—should therefore underpin training, technique selection and complication avoidance in contemporary facial contouring. Future research should prioritise population-specific anatomical variation and dynamic, in-vivo imaging of these systems to further refine the safety and precision of an already rapidly evolving field.

Conflict of Interest

The authors declare that there are no conflicts of interest to disclose in relation to the publication of this manuscript.

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Ethical Considerations

As this is a literature-based study, no human or animal subjects were involved, and thus no ethical clearance was required. However, due academic integrity was maintained through proper citation and referencing practices.

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