The fascial planes of the temple and face: an en-bloc anatomical study and a plea for consistency

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Summary Many investigators have detailed the soft tissue anatomy of the face. Despite the broad reference base, confusion remains about the consistent nature of the fascial anatomy of the craniofacial soft tissue envelope in relation to the muscular, neurovascular and specialised structures. This confusion is compounded by the lack of consistent terminology. This study presents a coherent account of the fascial planes of the temple and midface. Ten fresh cadaveric facial halves were dissected, in a level-by-level approach, to display the fascial anatomy of the midface and temporal region. The contralateral 10 facial halves were coronally sectioned through the zygomatic arch at a consistent point anterior to the tragus. These sections were histologically prepared to demonstrate the fascial anatomy en-bloc with the skeletal and specialised soft tissues. Three generic subcutaneous fascial layers consistently characterise the face and temporal regions, and remain in continuity across the zygomatic arch. These three layers are the superficial musculo-aponeurotic system (SMAS), the innominate fascia, and the muscular fasciae. The many inconsistent names previously given to these layers reflect their regional specialisation in the temple, zygomatic area, and midface. Appreciation of the consistency of these layers, which are in continuity with the layers of the scalp, greatly facilitates an understanding of applied craniofacial soft tissue anatomy.

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The subcutaneous layers of the scalp have been learned by generations of medical students according to the mnemonic SCALP, where S = skin, C = connective tissue, A = aponeurosis, L = loose areolar tissue, P = pericranium. This mnemonic has been extremely useful in demonstrating the generic simplicity of the soft tissue layers of the scalp, as well as acting as an aide memoire. By contrast, the fascial anatomy of the temple and midface have caused great confusion to many students and surgical trainees alike. The perceived complexities
have been generated in part by the large number of published anatomical and clinical studies, each giving a separate nomenclature to the consistent anatomical structure. An understanding of craniofacial soft tissue anatomy is, of course, a prerequisite to understanding both reconstructive and aesthetic surgical procedures in this area. The purpose of this report is to simplify the craniofacial fascial layers and provide a generic account of the fasciae of the temple and midface, within the context of their regional specialisation around skeletal, muscular, glandular and neurovascular structures.

Materials and methods

Ten fresh cadaveric heads were used for this study. Ten hemifacial specimens were subjected to a level-by-level planar dissection of the subcutaneous fasciae from skin to bone or muscle. The contralateral hemiface in each case was subjected to excision of an 8 cm coronal strip of tissue, taken at the junction of the posterior and middle thirds of the zygomatic arch. Each strip was incised down to temporalis muscle above and masseter muscle below, thereby including a segment of the zygomatic arch. Each strip was fixed in 10% neutral formalin and then subjected to coronal section. Having been paraffin-embedded, these blocks were cut at 5 μ and stained with haematoxylin, eosin and safron.

Results

The fascial anatomy of the temple

The generic fascial anatomy of the temple is demonstrated in Fig. 1. The scalp and subcutaneous fat and connective tissue have been reflected anteriorly to show the layers of fasciae beneath. The most superficial layer is the temporoparietal fascia, which often demonstrates muscle fibres in surgical dissections. This is the generic aponeurotic fascia, and it continues cranially as the galea of the scalp (SCALP), and anteriorly as the orbital and most superficial part of the orbicularis oculi muscle. The second layer is a loose fascial layer, highly vascularised, and rather fragile, continuing cranially as the subgaleal fascia, or the alternatively named ‘loose connective tissue’ layer of the mnemonic SCALP. In generic terms, this second layer of vascularised fascia is the innominate fascia. The deepest layer is the tough, thick, white temporalis muscle fascia, which continues cranially as the cranial periosteum (SCALP), in continuity at the temporal crest where temporalis takes its cranial origin.

This anatomy, as demonstrated in planar dissection, is corroborated by en-bloc histological section (Fig. 2). The five layers of the scalp, containing three generic fascial layers, are all represented in the temple. The temporoparietal fascia is the aponeurotic layer. Beneath this is the ‘loose connective tissue’ layer, or innominate fascia, and in histological section it retains its multilaminate or ‘loose areolar’ structure as in the SCALP. It is highly vascularised and not merely an avascular subfascial space as has been previously suggested. The third layer is the temporalis muscle (or deep temporal) fascia. This fascia splits into a thin superficial layer and a deeper, thicker and more fibrous layer, at the level of the supraorbital margin. The superficial lamina of the temporalis muscle fascia (deep
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(temporal fascia) is continuous with the unified temporoparietal fascia above the level of the orbit, and with pericranium above the level of the temporal crest. It has been called the intermediate temporal fascia, but in generic terms, the temporoparietal fascia is the deepest layer of the mnemonic SCALP. The splitting of the temporoparietal fascia into two laminae, separated by the ('middle' or 'intermediate') temporal fat pad, in functional terms allows the powerful contraction of temporoparietal fascia to be dissociated from tethering the temple.

The histological appearance of the innominate fascia of the temple is a potential source of confusion in considering the generic anatomy of the craniofacial fasciae. There appear to be multiple laminae, enclosing vascular planes. In the surgical approach, however, a single vascularised, innominate fascia is dissected (Fig. 3). The innominate fascia, richly vascularised by branches of the superficial temporal artery, can be raised as an ultrathin fascial flap for eyelid or auricular cover or as a free vascularised fascial bilayer transfer in the coverage of exposed tendons. It is a delicate flap in clinical use and should be raised with temporoparietal fascia in its caudal third to guard its blood supply. This bilayer fascial flap is a different entity from that described by several authors, which consists of a bilayer of the superficial lamina of the temporalis muscle fascia, vascularised by the middle temporal branch of the superficial temporal artery, and the innominate and temporoparietal fasciae raised together on the ascending branch of the superficial temporal artery. In theory, a multi-layer fascial flap could be raised, containing the three laminae as separate vascularised layers in pedicled or free tissue transfer.
The fascial anatomy across the zygomatic arch

En-bloc histological section across the zygomatic arch indicates that the generic structure of the craniofacial fascial envelope is maintained (Fig. 4). The temporoparietal fascia crosses the arch as the aponeurotic layer, deep to which is the loose areolar innominate layer. Despite previous reports to the contrary \(^4\), \(^11\) neither of these layers attaches to the zygomatic arch periosteum, and both are in continuity with the corresponding generic layers in the temple. The frontal (temporal) branches of the facial nerve lie immediately deep to the innominate fascia, between this and the zygomatic arch periosteum. This is entirely consistent with their course from the substance of the parotid gland, to eventually lie deep to the musculo-aponeurotic layer, within which the majority of the associated muscles are innervated by the VII nerve from their deep surface. This plane is characterised by a superficial temporal fat pad \(^1\), a ‘wafer-thin’ \(^2\) entity separating the innominate fascia from the zygomatic arch periosteum. In this context the fat pad which lies between the superficial and deep laminae of the temporalis muscle fasciae is the ‘middle’ or ‘intermediate’ fat pad. The deep temporal fat pad, often described as enveloping the temporalis tendon caudal to the zygomatic arch, was not seen in histological cross-section. It may be, that as this structure dives deeply below the arch it was out of the plane of our coronal cut samples. Alternatively, this deep temporal fat pad, also described as a temporal extension of the buccal fat pad \(^1\), may have descended out of the plane of our study in these cadavers as a consequence of the midfacial descent of normal ageing.

The zygomatic arch periosteum is in continuity with the superficial lamina of the temporalis muscle (deep temporal) fascia, and is, in generic terms, the deepest layer described by the mnemonic SCALP. The deep lamina of the temporalis muscle fascia (deep temporal fascia) remains intimately related to the temporalis muscle as it passes deep to the zygomatic arch, and does not attach to the arch periosteum (in contrast to the findings of Anderson and Lo \(^\) ). Temporalis muscle contraction is thereby unimpeded by attachment to the zygomatic arch.

The fascial anatomy of the midface

Caudal to the zygomatic arch, and overlying the region of the parotid gland, the aponeurotic layer of the midface is dissected as the superficial musculo-aponeurotic layer (SMAS) (Fig. 5), originally described by Mitz and Peyronie. \(^1\) This layer is continuous cranially as the temporoparietal fascia and galea, and caudally as the platysma. Deep to a SMAS flap, a glistening innominate fascia can be demonstrated as an independent layer, overlying the parotid gland, and continuing anteriorly to protect the parotid duct and branches of the facial nerve deep to it. In the midface, the innominate fascia is a single, thin sheet, and ‘plasters’ the parotid duct and emerging branches of the VII nerve deep to it in the mid-anterior cheek as the dissection proceeds anteriorly. When this layer is incised and raised, the parotid gland and duct are released into the wound, and facial nerve branches...
can be dissected freely. The floor of this 'space' is the masseteric fascia. The parotid duct gains the mouth by winding around the anterior border of masseter and traversing the buccal fat pad (Fig. 6).

In the midlateral cheek, the more proximal course of the VII nerve branches are protected deep to a SMAS flap by the innominate fascia and substance of the parotid gland. Careful dissection of a SMAS flap in this area leaves the innominate fascia intact over the parotid gland.

The deepest fascial layer, continuing caudally from the zygomatic arch periosteum, is the masseter muscle fascia, generically the same layer as the temporalis muscle fascia, and the scalp pericranium. This is demonstrated in histological section (Fig. 7). The SMAS and innominate fascia, now attenuated to a single layer, over the parotid, whereas the masseter muscle fascia remains applied to the muscle and is deep to the parotid gland and, more anteriorly, the parotid duct. The parotid gland is not enveloped by a single fascial layer that splits around it, but is a specialisation of regional anatomy that is accommodated within the generic structure of the craniofacial fasciae.

Discussion

The aim of this article is to present a simplified means of addressing a region of important surgical anatomy that is often misunderstood, and frequently confused in the surgical literature. There are three fascial layers in the craniofacial soft tissue envelope (Fig. 8). The deepest layer is the fasciae of temporalis and masseter, which is in continuity with periosteum at the bony attachments of these muscles. In the temple, this fascia is split and this facilitates the unimpeaded powerful contraction of temporalis muscle.

The intermediate layer is the innominate fascia, which in the temple, may in future have a useful
surgical application as an ultrathin pedicled flap for eyelid or auricular cover. We have noted in our dissections that the blood supply of this fascia is attenuated in its caudal aspect, and easily separable from its blood supply from branches of the superficial temporal artery. The masseter muscle (M-m) fascia (P) is deep to the parotid gland and continuous with the zygomatic arch periosteum (circled). There is no separate 'investing fascia' of the parotid gland. (VII—temporal branch of facial nerve).

The innominate fascia is the roof of the potential space, around the parotid, into which the branches of the VII cranial nerve emerge from their course within the parotid. Hence surgical procedures raising SMAS flaps anteriorly to the parotid will protect the VII nerve as long as the intact innominate fascia is deep to the dissection plane. However, the VII nerve branches eventually traverse the innominate fascia in their course to innervate the muscles of the SMAS, the majority of which receive innervation from their deep surfaces. In the zygomatic region, the safest surgical dissection plane to avoid temporal branch damage is subperiosteal. Elevating the subperiosteal midface suspension plane in aesthetic or reconstructive craniofacial surgery from a buccal

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**Fig. 7** Two plates from independent cadaveric subjects showing that the generic consistency of the fascial layers of the craniofacial soft tissue envelope are maintained in the midface. The SMAS (A) and innominate fasciae (L) are thin layers overlying the parotid gland (PG) and cranially continuous up over the zygomatic arch. The masseter muscle (M-m) fascia (P) is deep to the parotid gland and continuous with zygomatic arch periosteum (circled). There is no separate ‘investing fascia’ of the parotid gland. (VII—temporal branch of facial nerve).

**Fig. 8** Plate showing the generic consistency of the craniofacial fascial envelope. The ‘A’ layer is the superficial musculofascial layer and overlies the innominate (L) layer which is loose in the temple and adherent in the midface. The ‘P’ layer is the periosteal layer and continuous with the fasciae of the muscles which arise from it. Regional anatomical functional specialisation allows for splitting of the temporalis muscle fascia (P) above the zygomatic arch. Interposition of the parotid gland, regional blood supply, and facial nerve occurs between the innominate and aponeurotic layers in the midface. These layers are important reconstructive flap options above the zygomatic arch, and important landmarks in aesthetic surgery below the zygomatic arch (ifp—intermediate fat pad; sfp—superficial fat pad).
approach safely brings the instrument over the zygomatic arch subperiosteally. The more superficial, subinnominate fascial plane is gained by cleaving the superficial lamina of the temporalis muscle fascia from the zygomatic arch, above the level crossed by the VII nerve. Gosain et al.\textsuperscript{17} argued that the majority of the temporal branches of the VII nerve cross the middle third of the zygomatic arch. Taken with our observations, it would seem that a postero-anterior surgical exposure of the zygomatic arch in a subperiosteal plane, in combination with the coronal scalp flap would be the safest approach in craniofacial surgical exposure requiring access to the midface. Exposure of the upper third of the craniofacial skeleton without exposure of the zygomatic arch, would aim to sweep VII nerve forward in a combined skin—aponeurotic—innominate fascial flap, leaving the pericranium-temporalis fascial layer available for other adjunctive flaps as necessary. The most superficial layer is the aponeurotic layer in the subcutaneous plane. It is continuous with the orbital part of the orbicularis oculi anteriorly, and the peripheral part of the orbicularis oris antero-inferiorly. Inferiorly it contains platysma fibres, and superiorly, as the galea, it is in a continuous sheet with the frontalis and occipitalis. In the midface, the zygomaticus muscles and extrinsic lip elevators pass through it in reaching cutaneous insertion. Above the zygomatic arch the aponeurotic layer finds great use in reconstructive surgery as the temporoparietal fascial flap, used as a pedicled or free tissue transfer. This is also the plane of extended galeal or 'epicranial' flaps\textsuperscript{18} and these flaps may be pedicled on a variety of available scalp vessels. Below the zygomatic arch, the aponeurotic plane finds great use in aesthetic surgery, as a means of suspending the skin of the face and neck, and the relative benefits of its use remain the subject of hot debate amongst aesthetic surgeons.\textsuperscript{19}

References