

Determination of the Layers of Temporal Fascia

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Summary:

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Background: The temporal fascia has not been studied properly yet. Most Anatomy textbooks & literatures describe this fascia as being formed of two layers. In this study, careful dissection of this fascia was performed to prove or disprove this view.

Methods: The temporal fascia of five male cadavers were dissected, layers separated, identified & photographed.

Results: The temporal fascia was found to be formed of four layers rather than two as it is believed to be.

Conclusion: This finding may alter the view to this important structure both anatomically & clinically as it is widely used clinically.

Keyword: Temporal fascia, fascial flap

Introduction:

Fascial layers in the temporal region: Above the level of the zygomatic arch, on the lateral side of the head, deep to the skin & the fibro-adipose layer, the temporo-parietal fascia (sometimes called the superficial temporal fascia) constitutes a fascial layer which lies in the same plane as, but is not continuous with, the superficial musculoaponeurotic system (SMAS) of the face. It is quite separate from, and superficial to, the temporal fascia (sometimes called the deep temporal fascia). More superiorly, it blends with the galea aponeurotica above the superior temporal line. (1) The (SMAS) is described as a single tissue plane in the face. In some areas it is composed of muscle fibres, and elsewhere it is composed of fibrous or fibroaponeurotic tissue: it is not directly attached to bone. (2) The plane between the temporo-parietal fascia and the underlying deep temporal fascia contains loose areolar tissue and a small amount of fat. This tissue plane, the temporo-parietal fat pad, is continuous superiorly with the subgaleal plane of loose areolar tissue in the scalp. This areolar layer allows the superficial scalp to move freely over the deeper and more fixed temporalis muscular fascia, temporalis muscle, and pericranium (3) The temporal fascia (deep temporal fascia) is a dense aponeurotic layer which lies deep to the temporo-parietal fat pad and covers temporalis, the deep surface of the fascia affords attachment to the superficial fibers of this muscle. Above, it is a single layer attached along the length of the superior temporal line, blending with the periosteum. Below, at approximately the level of the superior orbital rim, it splits into superficial and deep laminae which run downwards to attach to the lateral and medial margins of the upper border of the zygomatic arch respectively. (1) The further division of the temporalis muscular fascia into a superficial and deep layers created another space containing another fatty tissue pad. (3) The temporal & zygomatic

branches of the facial nerve lie just superficial to the deep temporal fascia (4). The zygomatico-orbital branch of the superficial temporal artery and the zygomatico-temporal branch of the maxillary nerve lie in the superficial temporal pad of fat. The temporal fascia is overlapped by auriculares anterior and superior, the epicranial aponeurosis and part of orbicularis oculi. The superficial temporal vessels and auriculotemporal nerve ascend over it. (1) The superficial temporal artery supplies the temporoparietal fascia. The artery emerges from the parotid tissue, gives off the middle temporal artery, and traverses a tortuous course in the preauricular area. Approximately 3 cm above the zygomatic arch, it divides into the terminal frontal and parietal branches. The superficial temporal vein generally runs superficial to and with the artery, but variability, including branching or a posterior course, may be encountered. (3) Clinical applications on the temporal fascia: Temporal fascia is widely used clinically mainly in the following cases: Temporoparietal fascial flap: The use of temporoparietal fascia flap was first described by Golovine in 1898. (3) In 1983, Brent et al reported the successful use of the flap as an axial-pattern fascial flap, a random-pattern fascial flap, and a free fascial flap for secondary ear reconstruction. (5) In 1993, Cheney et al described 21 cases using the flap for a variety of reconstructions in head and neck. (6) Today, the temporoparietal flaps remain the only single-layered fascia flap that can be used as a pedicled vascular flap in the head and neck. (7) Reduction of zygomatic arch fractures: The split deep temporal fascia into superficial and deep laminae which run downwards to attach to the lateral and medial margins of the upper surface of the zygomatic arch have a clinical application in the reduction of fractures of the zygomatic complex via a Gillies approach, an instrument is inserted deep to the deep lamina of temporalis fascia through a scalp incision and used to elevate depressed zygomatic complex fractures. (8) Tympanic membrane graft

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in myringoplasty: Closing tympanic membrane perforations by using temporalis fascia has been practiced in the last decades. In standard myringoplasty, a temporalis fascia graft is placed medially to the tympanic membrane remnant or laterally under the tympanomeatal skin flap. (9)

Materials & methods:

Over the last few years, separate sessions of dissection of the temporal regions performed, a session was done whenever a suitable cadaver becomes available. Five mature, male cadavers, embalmed in 40% formaldehyde solution for 6 months in the dissecting rooms of the Department of Anatomy, College of Medicine were used. The temporal regions of some cadavers were dissected bilaterally & some were subjected to unilateral dissection according to the state of embalming & position of the head, the overall dissected regions were eight, three dissected bilaterally and two unilaterally. Dissection started from the skin down to the temporalis muscle fibers, taking in consideration, careful separation of the successive layers from each other, definition of the extension of each layer, definition of their bony attachments, determination of fusion of these layers with each other & with other structures, identification of the position & course of regional vessels & nerves in relation to them. Some layers were painted with specific colors was done for the last cadaver dissected & the last region dissected was photographed using a high resolution digital camera (Sony, snapshot, DSC-H155).

Results:

The following findings were noted: Fascial layers: Layer (I): An external layer which is in continuity with the epicranial aponeurosis and having no or minimal attachment to the superior temporal line, it lies superficial to the other layers. (Fig. 1, 2, 3 -A). Layer (II): A second layer attached to the superior temporal line extending downward to be attached to the lateral margin of the upper border of the zygomatic arch. This layer is completely separate from the layers superficial & deep to it. (Fig. 2, 3, 4, 5 -B) Layer (III): A third layer attached to inferior temporal line, this layer seems to be separate from the overlying & underlying layers & is attached to the medial margin of the upper border of the zygomatic arch. (Fig. 3, 4, 5 -C) Layer (IV): A fourth layer attached to muscular attachment of the temporalis muscle. This layer splits above the Zygomatic arch into a thicker layer attached to the medial border of the zygomatic arch & a thinner one continues on the temporalis and is attached downward to the coronoid process and mandibular notch. (Fig. 4, 5 -D) Fatty layers: Two fatty pads were identified, a superficial pad between fascial layers I and II & a deep pad between fascial layers III & IV (Fig. 5 - E, Fig. 6) Distribution of vessels & nerves: The superficial temporal artery & its branches are seen to lie in the plane between layers I & II. (Fig. 2 - arrow), the superficial temporal vein accompanies the artery, auriculotemporal, zygomaticotemporal & the zygomatic branch of facial nerve all lie in this plane. Vascular & nervous twigs seen traversing these layers.

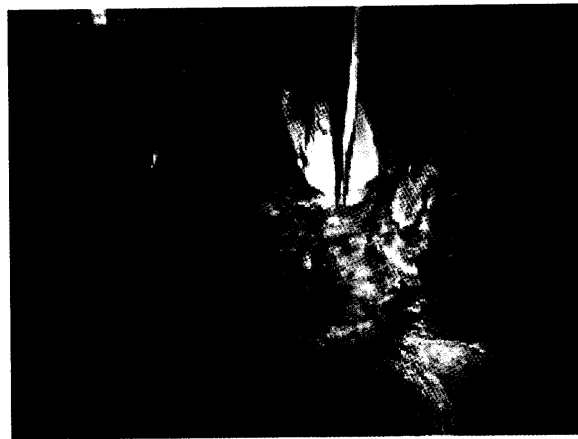


Figure 1: showing the epicranial aponeurosis (painted with black) & layer I (A)



Figure 2: showing layer I (A) & layer II (B), the arrow points to the superficial temporal artery in the plane between these layers



Figure 3: showing layer I (A) held by the needle pointer, a round window made in layer II (B) overlying the spatula, note its attachment to the superior temporal line, & layer III (C)

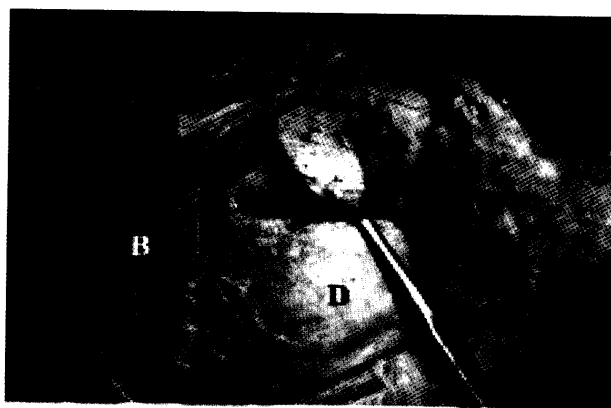


Figure 4: showing layer II (B) reflected, layer III (C) & layer IV (D)



Figure 5: showing layer II (B), layer III (C), layer IV (D) & the deep fatty pad (E)



Figure 6: demonstrating the deep fatty pad

Discussion:

Anatomists studied the layers of temporal fascia with some confusion, three layers of the fascia were recognized & described by them, yet, all literatures in this field mentioned that the temporal fascia is formed only of two layers (1, 3), or even one layer (4, 10, 11). Misnaming, misrecognition of the layer splitting, or failure to follow them thoroughly

may contribute in this confusion. Standring regarded the superficial temporal fascia as the layer which lies in the same plane of the epicranial aponeurosis & have no attachment to the temporal lines (i.e: layer (I) in this study) and the deep temporal fascia which is attached to the superior temporal line (i.e: layer II in this study). (1) Last and Moore et.al described the temporal fascia as the layer which is attached to the superior temporal line and then it splits into two layers, a superficial one attached to the outer margin of the upper border of the zygomatic arch & a deep layer attached to the medial margin of the upper border of the zygomatic arch (i.e: layers (II) & (III) in this study). (4, 10) They didn't mention the superficial layer as being a temporal fascia. Woodburne described the fascia in a similar way to the description of Last and Moore et.al., with an additional point that the superficial layer extends below the zygomatic arch as the masseteric fascia. (11) Masseteric & parotid fasciae were regarded by Standring as a continuation of the superficial temporal fascia. (1) In the above descriptions, we noticed that the outer three layers described by this study were identified & mentioned by these anatomists with variations in the names applied to these layers, but layer (IV) has not been described by any literature reviewed in this aspect, possibly because its outer lamina has the same attachment of layer (III) which is regarded as the deep lamina of the splitted deep temporal fascia. (3, 4, 10, 11)

Conclusion:

Temporalis fascia is formed of four separate layers

Three of these layers were identified by researcher in this discipline with variations in the names applied to each layer

The fourth layer has not been mentioned or described yet

This finding may alter the view to this fascia which is used widely in clinical applications

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