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A Stratigraphic Approach to the Superficial Musculoaponeurotic System and Its Anatomic Correlation with the Superficial Fascia

Lydia M. Ferreira, Bernardo Hochman, Rafael F Locali, and Leonardo M. Q. Rosa-Oliveira

Discipline Plastic Surgery/Department of Surgery, São Paulo Federal University (UNIFESP-EPM), Rua Napoleão de Barros, 715, 4th Floor, São Paulo 04024-900, Brazil

Abstract. The superficial musculoaponeurotic system (SMAS) is not included in the *International Anatomic Terminology*, although it is a fundamental anatomical structure in plastic surgeons. In the literature, the concept of the SMAS is not clear, leading to repercussions in the treatment of the SMAS via the various techniques for rhytidoplasty. This review article, in its aim to conceptualize the SMAS, has as a referential parameter the basic stratigraphic pattern of the human body construction. A systematic review of the literature was performed through Medline, ISI-Web of Science, and Lilacs databases as well as through classical treatises of anatomy for analyses of the stratigraphic principle of SMAS and its relationship to the fascia. In fact, SMAS, an anatomic entity, is part of this construction model. The stratigraphic approach followed in this article to describe the SMAS is novel in the literature and allows for a unified anatomic understanding of SMAS for the scientific community.

Key words: Anatomy—Face—Subcutaneous tissue—Superficial musculo-aponeurotic system

Despite all the available techniques for rhytidoplasty, there is a lack of consensus on the anatomic definition of the superficial musculoaponeurotic system (SMAS), a fundamental structure in these surgeries. This lack of understanding begins with the absence of this anatomic structure from both the *International Anatomic Terminology*, and the classical treatises of anatomy. This gap has given rise to an ongoing controversy in the rhytidoplasty-related literature.

Correspondence to B. Hochman; *email:* bernardohochman@uol.com.br

In 1976, Mitz and Peyronie [21] were the first to describe this "new" anatomic structure. In the view of these authors, the SMAS splits the subcutaneous screen into two layers. In the superficial layer, tenuous fat lobes intersperse with fibrous septa inserted in the dermis. In the deep layer, all the way to the face muscles, the fat is more abundant and not permeated by these septa [21]. However, the repercussions for SMAS treatment via the several techniques for rhytidoplasty require a more refined understanding of the SMAS concept.

After Mitz and Peyronie [21], this structure was considered a fibrous degeneration of the platysma [16], or a distinct fibromuscular layer composed of platysma muscle and parotid fascia [28]. Other authors have described the SMAS as an extension of the cervical superficial fascia [26], a musculoaponeurotic layer in continuity with the platysma [11], or even as an evolutionary form of the panniculus carnosum present in inferior animals [8].

Indeed, existence of several different concepts of the SMAS, many derived from well-structured and, at times, complementary anatomic studies, suggest a single and comprehensive explanation, a fundamental feature of science. Therefore, this review article, in its aim to conceptualize the SMAS, has as a referential parameter the basic stratigraphic pattern of the human body construction.

Databases Consulted

A search was conducted for all the articles in the literature through Medline, ISI-Web of Science, and Lilacs, as well as through classical treatises of anatomy, on the analysis of the stratigraphic principle of the SMAS and its relationship to the fascia.

Results

The human body, like that of all vertebrates, is built stratigraphically (i.e., through the overlapping of layers of the same tissue or several different tissues). This well-established type of construction can be observed not only in the body segments, but also within each particular organ. The study of stratigraphy corresponds, therefore, to that of organ histiotopia.

In the skin, there is a superficial layer constituted by the epidermis and a deep layer constituted by the dermis. The subcutaneous screen shows three fundamental layers or strata. From the surface down, there is the areolar layer, the superficial fascia, and the lamellar layer. Further down, there is the deep fascia and the muscular plane itself [12,24].

Although the term "fascia" is used more often with the restricted meaning of fibrous membrane, it is an integral part of the conjunctive tissues in general. This concept allows us to consider all the fascial structures as part of both morphologic and functional systems. This conjunctive tissue, according to the functional demands of the body topography in question, adapts itself by varying its thickness, density, and fat buildup, as well as by the relative amounts of collagen, elastic fibers, and tissue fluid [12].

Therefore, because both the superficial fascia and all the other layers are continuous throughout the body, their stratigraphic pattern may present alterations and apparent imperfections, and may even appear to be absent in certain anatomic regions. Besides being undetectable as a layer, it may change due to the exaggerated development of its thickness [12]. In the face, which is a region with singular functional activity, represented by the muscular activity of the facial mimic motion, the adaptive morphologic alteration of the superficial fascia clashes with the concept that the SMAS is a localized thickness of this fascia [14,20,21,25,26].

It also is accepted that the platysma, from an anatomic and surgical dissection point of view, is a muscle that is continuous and on the same plane as the SMAS [2,3,5,21,31,32]. Both structures, existing on the same anatomic plane, can be approached as one single real structure, in this case the superficial fascia. The histologic difference between the type of tissue composing the SMAS and that composing the platysma (fibrous and muscular tissue, respectively) is possible due to an evolutionary mechanism of cellular differentiation in both structures, because both arise from the same mesenchymal embryologic origin [12,32].

This evolutionary phenomenon is confirmed by the fact that the SMAS contains several types of fibers and tissues in its matrix, namely, collagen fibers, elastic fibers, fat cells, and even muscle cells, all of which are mesenchymal in nature [11,15,17,21,28]. Similarly, in the superior direction, the SMAS is continuous and on the same plane as the temporal superficial fascia [1,13,19,22,27,30], which maintains the same relationship to the pericardial aponeurosis, and thus to the superficial fascia on the back of the neck, closing the stratigraphic plane of this tissue in the head [4,22,29,30]. In the cervical region, this adaptive phenomenon would have led to the absence of the areolar layer.

The SMAS in the parotideomasseteric and zygomatic region is thicker and, by means of its dermic insertions, transmits the action of the mimetic muscle system to the skin. On the other hand, in the infraorbital region, the SMAS becomes invisible macroscopically and nondissectable as an anatomic structure. Still, it keeps exercising control of the muscular contraction over the skin by means of thin specialized fibrous terminations inserted in the local dermis. These dermic insertions also go toward both the upper lip and the nasal region. In the latter, the insertions flow together under the nose skin, crossing to the contralateral side and reestablishing the continuity of the SMAS or, more specifically, of the superficial fascia in the face [6,7,9,10,18,23].

Therefore, in the cranial caudal direction, the epicranial aponeurosis and, bilaterally, the superficial temporal fascia, the SMAS, and the platysma constitute the very superficial fascia, only with different denominations, depending on the region comprised. The fibrotic terminal insertions of the SMAS in the central region of the face, because they do not constitute a well-defined anatomic surgical structure, do not receive a regional denomination, although they also constitute the superficial fascia.

Discussion

The stratigraphic approach followed in this article to describe the SMAS is novel in the literature. This basic principle of human body construction allows us to integrate the conceptual miscellany concerning the SMAS. Besides suggesting that this structure is the very superficial fascia, this stratigraphic principle allows for the correlation between the deep fascial structures of the face and the SMAS. Therefore, the parotid, masseteric, and deep temporal fasciae constitute, in a unique way, the deep fascia in the face, and all similarly are regional denominations of the same structure.

According to the stratigraphic approach, the seemingly regional absence of one of the layers represents evolutionary, functionally dependent adaptations. Thus, besides the absence of the areolar layer in the neck described earlier, there has been fat cell hypertrophy in the face under the superficial fascia in the cheek region (i.e., in the lamellar layer) known as the adipose body of the cheek (Bichat's Ball), a recognized structure described by the *International Anatomic Terminology*. Moreover, on the surface of the superficial fascia of the zygomatic region (i.e., in

the areolar layer), a similar phenomenon is supposed to have occurred. This fatty structure is known in the field of plastic surgery as "prezygomatic fat" or, more commonly, as the malar fat pad. However, as with the SMAS, this adipose body is not recognized and not included in the *International Anatomic Terminology*.

This type of stratigraphic approach also demonstrates the need for a better integration between anatomists and surgeons because studies in the field of anatomy have a direct bearing on the field of surgery. There should not be a structure termed "surgical," as is the SMAS, that is not described in the *International Anatomic Terminology*, when even small bone projections receive their own denominations. After all, could it be that the presence of the SMAS is less frequent than the presence of bone projections? Surgical practice has not empirically demonstrated such a difference.

References

1. Campiglio GL, Candiani P: Anatomical study on the temporal fascial layers and their relationships with the facial nerve. *Aesth Plast Surg* **21:**69–74, 1997
2. Cárdenas-Camarena L, González LE: Multiple, combined placations of the SMAS–platysma complex: Breaking down the face-aging vectors. *Plast Reconstr Surg* **104:**1093–1100, 1999
3. Castro CC: Superficial musculoaponeurotic system-platysma: A continuous study. *Ann Plast Surg* **26:**203–211, 1991
4. Dzubow LM: The fasciae of the face: An anatomic and histologic analysis. *J Am Acad Dermatol* **14:**502–507, 1986
5. Ferreira LM, Oliveira AF, Hochman B: Anatomia da face. In: *Videoendoscopia em cirurgia plástica: Teoria e prática—manual de videoendoscopia*. 1st ed. Disciplina de Cirurgia Plástica UNIFESP-EPM: Sao Paulo, pp 8–19, 2004
6. Figallo E, Acosta JA: Nose muscular dynamics: The tip trigonum. *Plast Reconstr Surg* **108:**1118–1126, 2001
7. Firmin F: The superficial muscle aponeurotic system of the nose (discussion). *Plast Reconstr Surg* **82:**48, 1988
8. Fodor PB: From the panniculus carnosum (PC) to the superficial fascia system (SFS). *Aesth Plast Surg* **17:**179–181, 1993
9. Galli J, Zavalla CA, Vivas DG, Prado C, Zanetta GC: New surgical concepts: Nasal tip function. *Aesth Plast Surg* **21:**240–242, 1997
10. Ghassemi A, Prescher A, Riediger D, Axer H: Anatomy of the SMAS revisited. *Aesth Plast Surg* **27:**258–264, 2003
11. Gosain AK, Yousif NJ, Madiedo G, Larson DL, Matlob HS, Sanger JR: Surgical anatomy of the SMAS: A reinvestigation. *Plast Reconstr Surg* **92:**1254–1263, 1993
12. Gray H: Músculos e fóscias. In: Anatomia. 29th ed. Guanabara Koogan: Rio de Janeiro, pp. 307–312, 1977
13. Hamra ST: A study of the long-term effect of malar fat repositioning in face-lift surgery: Short-term success but long-term failure. *Plast Reconstr Surg* **110:**940–951, 2002
14. Har-Shai Y, Bodner SR, Egozy-Golan D, Lindenbaum ES, Ben-Izhak O, Mitz V, Hirshowitz B: Viscoelastic properties of the superficial musculoaponeurotic system (SMAS): A microscopic and mechanical study. *Aesth Plast Surg* **21:**219–224, 1997
15. Har-Shai Y, Sela E, Rubinstein I, Lindenbaum ES, Mitz V, Hirshowitz B: Computadorized morphometric quantitation of elastin and collagen in SMAS and facial skin and possible role of fat cells in SMAS viscoelastic properties. *Plast Reconstr Surg* **102:**2466–2470, 1998
16. Jost G, Levit Y: Parotid fascia and face lifting: A critical evaluation of the SMAS concept. *Plast Reconstr Surg* **74:**42–51, 1984
17. Kikkawa DO, Lemke BN, Dortzbach RK: Relations of the superficial musculoaponeurotic system to the orbit and characterization of the orbitomalar ligament. *Ophthal Plast Reconstr Surg* **12:**77–88, 1996
18. Letourneal A, Daniel RK: The superficial musculoaponeurotic system of the nose. *Plast Reconstr Surg* **82:**48–57, 1988
19. Lucarelli MJ, Khwarg SI, Lemke BN, Kozel JS, Dortzbach RK: The anatomy of midfacial ptosis. *Ophthalmic Plast Reconstr Surg* **16:**7–22, 2000
20. Mendelson BC: Surgery of the superficial musculoaponeurotic system: Principles of release, vectors, and fixation. *Plast Reconstr Surg* **107:**1545–1552, 2001
21. Mitz V, Peyronie M: The superficial musculoaponeurotic system (SMAS) in the parotid and cheek area. *Plast Reconstr Surg* **58:**80–88, 1976
22. Moss CJ, Mendelson BC, Taylor GI: Surgical anatomy of the ligamentous attachments in the temple and periorbital regions. *Plast Reconstr Surg* **105:**1475–1490, 2000
23. Pensler JM, Ward J, Parry SW: The superficial muscle aponeurotic system in the upper lip: An anatomic study in cadavers. *Plast Reconstr Surg* **75:**488–494, 1985
24. Sousa OM: Plano de construção do corpo humano. In: *Anatomia topografia: Parte geral*. 3rd ed. Rossolillo: Sao Paulo, pp. 60–62, 1970
25. Stuzin JM, Baker TJ, Gordon HL: The relationship of the superficial and deep facial fascias: Relevance to rhytidectomy and aging. *Plast Reconst Surg* **89:**441–449, 1992
26. Stuzin JM, Wagstrom L, Kawamoto HK, Wolf SA: Anatomy of the frontal branch of the fascial nerve: The significance of the temporal fat pad. *Plast Reconstr Surg* **83:**265–271, 1989
27. Tellioglu AT, Tekdemir I, Erdemli EA, Tüccar E, Ulusoy G: Temporoparietal fascia: An anatomic and histologic reinvestigation with new potential clinical applications. *Plast Reconstr Surg* **105:**40–45, 2000
28. Thaller SR, Kim S, Patterson H, Wildman M, Daniller A: The submuscular aponeurotic system (SMAS): A histologic and comparative anatomy evaluation. *Plast Reconstr Surg* **86:**690–696, 1990
29. Tolhurs DE, Carsterns MH, Greco RJ, Hurwitz DJ: The surgical anatomy of scalp. *Plast Reconstr Surg* **87:**603–612, 1991
30. Vasconcellos JJA, Brito JA, Henin D, Vacher C: The fascial planes of the temple and face: An en bloc anatomic study and a plea for consistency. *Br Ass Plast Surg* **56:**623–629, 2003

31. Whetzel T, Stevenson T: The contribution of the SMAS to the blood supply in the lateral face lift flap. *Plast Reconstr Surg* **100:**1011–1018, 1997

32. Zigiotti GL, Liverani MB, Ghibellini D: The relationship between parotid and superficial fasciae. *Surg Radiol Anat* **13:**293–300, 1991