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Advancements in dermatologic ultrasound and its use in facial aesthetic interventions

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The various interpretations of what the superficial musculoaponeurotic system (SMAS) is have been widely discussed by anatomists, surgeons, and histologists. Despite its anatomical and functional importance, this structure gained prominence only in 1976, when Mitz and Peyronie described it as a superficial subcutaneous fascia that includes the platysma muscle and is fused to the external surface of the parotid fascia, designating it the SMAS[(1,2)].

Currently, the SMAS represents the entire basis for facial support and remodeling. The evolution of facelift techniques began in the 20th century with advances by Miller and contributions by Holländer and Lexer. Techniques developed from the 1960s through the 1990s revolutionized the results: the endoscopic methods and nonsurgical alternatives developed in the 1990s gained prominence[(2–4)]. In addition to the initial interest from plastic surgeons and anatomists, the SMAS has recently become familiar to radiologists and sonographers because imaging can be employed to guide approaches to the system[(5–7)].

The SMAS consists of a three-dimensional architecture of collagen fibers, elastic fibers, and fat cells, with numerous projections to the dermis; that is, it is a fibromuscular layer that covers and interconnects the muscles of facial expression. Therefore, it is able to transmit the actions of the muscles of facial expression in two directions, thus distributing all facial muscle contractions to the skin[(1,5)].

The article “U-SMAS: ultrasound findings of the superficial musculoaponeurotic system”, authored by Zattar et al.[(8)] and recently published in **Radiologia Brasileira**, summarizes the SMAS from an anatomical point of view and describes its correlation with ultra-high-frequency ultrasound (U-SMAS) findings, presenting this technique in a detailed and precise manner. The practical importance of studying this anatomy of the face and knowing how to identify the SMAS in the different regions is due to several factors. That knowledge can facilitate the planning of surgical interventions or noninvasive treatments, as well as the accurate diagnosis of complications such as vascular migration and obstruction[(7,9)].

The Zattar et al.[(8)] study clearly demonstrates the differences between the subcutaneous tissue of the face/neck and that in the rest of the body, highlighting the complex organization of the SMAS. The description of the five distinct types of morphology and detailed imaging patterns of the SMAS observed with high-frequency (24–33 MHz) transducers makes their study valuable for demonstrating the consistency of the ultrasound findings, as well as their reproducibility. Another point to highlight is that dermatologic ultrasound, with high-frequency transducers, is better able to characterize the anatomical findings and to differentiate between the layers of the SMAS than are other methods, such as computed tomography and magnetic resonance imaging.

The use of dermatologic ultrasound has grown exponentially in recent decades and has rapidly moved from the experimental phase to routine daily practice in several countries. This imaging modality requires color Doppler ultrasound devices working with high-frequency transducers, new post-processing techniques, skilled operators with specialized training, familiarity with standardized protocols, and correct image interpretation[(6,7,9)].

In the field of aesthetics, adequate knowledge of facial anatomy is essential, because of the considerable anatomical and vascular variations, which compromise the safety of injection procedures if there is no prior vascular mapping. To improve the safety and precision of procedures in some high-risk areas (danger zones), the use of ultrasound-guided injections, with real-time visualization, has been established as the safest method[(6,7,9)].

Currently, with devices that employ multifrequency transducers ≥ 15 MHz, it is possible to study tumors, as well as congenital, inflammatory, vascular, and other diseases, of the skin and its appendages, in a noninvasive manner and in real time[(5,6,9)]. In the face, high-frequency ultrasound not only helps guide procedures but also allows noninvasive evaluation, being able to identify the presence of different types of fillers and to evaluate (inflammatory and noninflammatory) nodules, as well to identify their location and effects on the facial anatomy. Color Doppler is essential in dermatologic ultrasound analyses

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and collaborates in the diagnosis of tumors of the skin, as well as in the evaluation of the response to clinical or surgical treatment, thus being used to monitor the effectiveness of treatments and wound healing[7,9].

Preoperative neurovascular mapping is another innovative area, as is preintervention ultrasound mapping of vascular structures, which is increasingly being used in aesthetic interventions before filler injection, to ensure that filler-induced vascular occlusion does not occur[7,9]. In the management of skin lesions, especially in the facial area, preoperative ultrasound can help identify arteries, veins, and even nerves before surgical intervention, and intraoperative ultrasound is our greatest innovation.

There is a growing global movement to standardize dermatologic ultrasound protocols, which include guidelines on how to perform examinations, which images to capture, and how to interpret the findings. Such standardization will improve the consistency and reliability of diagnoses[5,9].

With the advancement of technology, portable and affordable ultrasound devices have become widely available. That has allowed dermatologic ultrasound to be applied in settings ranging from the intraoperative to primary care, making it an increasingly valuable tool in clinical practice, as demonstrated in the study conducted by Zattar et al.[8].

The advances in dermatologic ultrasound have been significantly influenced by the development of high- and ultra-high-frequency transducers, the provision of guidelines for performing the examinations, and a growing number of studies in the field[8].

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