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THE SUBMALAR TRIANGLE

Its Anatomy and Clinical Significance

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Throughout life the process of aging sculpts the face in certain constant and predictable ways. These changes include loss of elasticity in the skin, shrinkage of skeletal mass, atrophy of fat, and weakening of the associated enveloping structures. These structural alterations combine to produce the familiar signs of aging such as facial wrinkling, jowls, anterior facial folds, and redundant neck skin.

However, it is the changes in the deep soft tissues of the midface that contribute most profoundly to the characteristics of aging. These degenerative alterations cause a loss of robustness and youthful contour to the face. These transformations are related directly to morphologic changes occurring in the buccal fat pad and the adjacent subcutaneous fat.[2,3,10] The loss of this inherent deep anatomic substructure manifests itself as a predictable change in surface anatomy, comprising a roughly triangular flattening, or depression, that is confined within relatively constant landmarks of the midface.

By using MR imaging the degenerative changes of aging that occur in the soft tissue structures of the face can now be correlated radiologically with the surface changes found clinically.[6] Based on these observations, we describe a clinically predictable area of midfacial aging bordered by the nasolabial fold, the masseter muscle, and the malar prominence. We term this region the submalar triangle (Fig. 1).

In this study the anatomy and clinical features of the submalar triangle are defined and correlated directly with the results of MR imaging scans that were taken of the submalar triangle in five patients. The evaluation of the extent of changes within this triangle provides the surgeon with a valuable tool in determining the patient's suitability for various types of midfacial rejuvenation procedures.

ANATOMIC CONSIDERATIONS

The key elements of the midface that contribute structurally to the anatomy of the submalar triangle include the buccal fat pad, the masseter muscle, the zygomatic bone, and the nasolabial fold.

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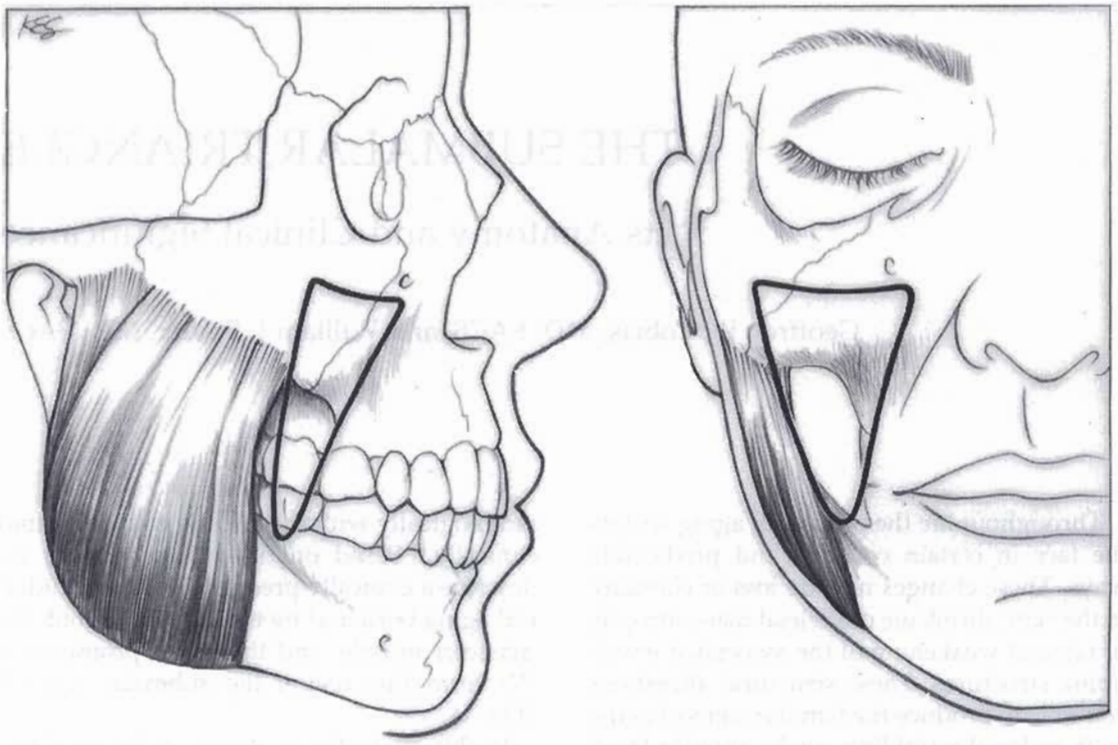

Figure 1. The location and extent of the submalar triangle.

Buccal Fat Pad

The buccal fat pad represents the central portion of the submalar triangle. The buccal fat pad was first described by Heister in 1732.[9] Bichat[1] is credited with recognizing its fatty nature and the buccal fat pad is sometimes refered to as Bichat's ball.[7,11] It has a triangular shape of up to 4 cm, with extensions between the masseter, temporalis, and pterygoid muscles. The buccal fat pad contributes to the cherubic face of infancy and childhood.[5,10] It provides a favorable environment for smooth functioning of the muscles of mastication.[11,14]

The buccal fat pad lies within a well-defined facial cleft superficial to the buccinator muscle and deep to the superficial musculoaponeurotic investing fascia. Filling the cleft are the buccal or body portion of the fat pad, sometimes referred to as the corpus adiposum buccinae. Anteriorly it extends to the skin surface and is responsible for the bulk of the cheek contour. Posteriorly the buccal fat pad dips beneath the masseter muscle and extends to the temporal area.[10,11]

Masseter Muscle

Externally, the body of the masseter muscle represents the posterior border of the submalar triangle.[8] This muscle runs vertically and forms a ridge under which the buccal fat descends. The anterior border of the muscle can be palpated readily or seen when clenching the jaw.

Nasolabial Fold

The anterior border of the submalar triangle is the nasolabial fold, which runs obliquely from the ala nasa and lateral to the commissures of the lips. At the level of the fold, the

superficial fascia is very thin. The fold itself is composed of redundant skin and scant subcutaneous fat which overlie the confluence of insertions of the elevator muscles to the upper mouth.[11,12]

Malar Prominence

The superior border of the submalar triangle is defined by the malar prominence. The structure that is the anterior portion of the zygomatic bone is sometimes referred to as the maxillary process.[8]

Additional Structures

The parotid duct and the terminal branches of the facial nerve cross the lateral surface of the buccal fat pad as they enter the cheek. The facial artery and vein ascend from the anterior border of the masseter muscle in the same plane as the buccal fat pad.[8,11] The superficial musculoaponeurotic system overlies the buccal fat pad and the facial muscles and is thin and discontinuous, contributing little to the contour in the area of the midface delimited further by the submalar triangle (see Fig. 1).

RADIOLOGIC CORRELATES

The age-related changes in the submalar triangle consisting of the progressive decrease in volume of the deep soft tissues, most notably in the fatty component, diminish the general support for overlying integumentary structures.[10] However, these changes have not been substantiated or associated with corresponding clinical correlates.

Magnetic resonance imaging now makes it possible to identify the age-related degenerative processes occurring in the subcutaneous tissues of the midface. Davis et al[6] used MR imaging to study the soft tissue components of facial anatomy. The MR imaging characteris-

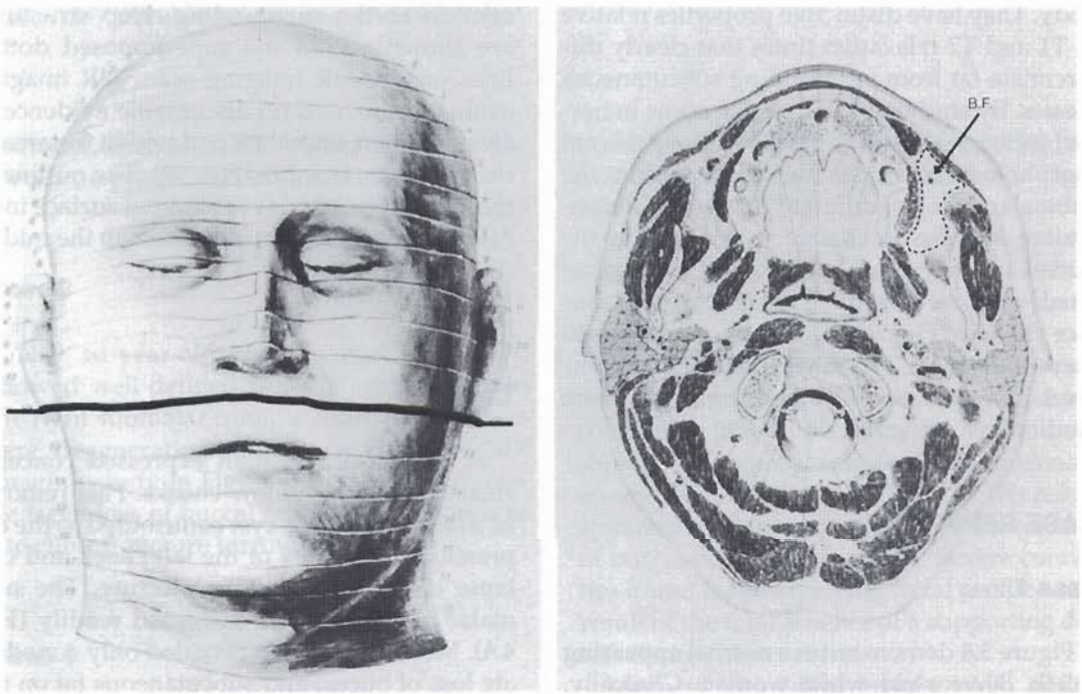

Figure 2. Level of the buccal fat pad (coronal plane). MR imaging scans were taken at this location in all patients to evaluate the consistency and volume of buccal fat.

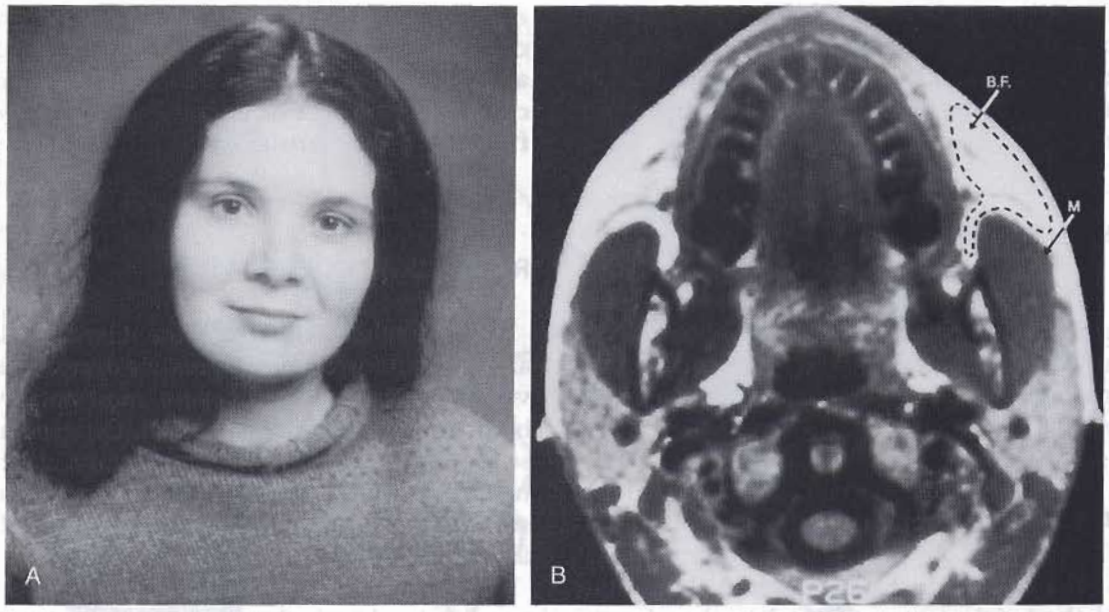

Figure 3. *A*, Case 1. Photograph of normal appearing, 135-pound, 30-year-old woman. *B*, MR image of patient in *A*. Dotted line shows location of buccal fat pad (BF). Note location of masseter muscle (M).

tics of fat are unique among the tissues of the body. They have distinctive properties relative to T1 and T2 relaxation times that clearly differentiate fat from surrounding subcutaneous tissues. By studying MR imaging scans in normal individuals and in those with significant morphologic changes identified within the submalar triangle, different degrees of degenerative soft tissue change found within the buccal space were delineated and then correlated with the overlying integumentary surface changes. Figure 2 illustrates a midcoronal view of the head. This corresponds to the same level at which the MR imaging scans were studied involving the buccal fat.

CASE REPORTS

Case 1

Figure 3*A* demonstrates a normal appearing 135-lb, 30-year-old white woman. Clinically, this individual reveals no evidence of soft tissue deterioration or characteristics of facial aging. The extent of the buccal fat pad and its relation to the surrounding deep structures are shown within the superimposed dotted lines on the MR imaging scan. MR imaging evaluation reveals no discernable evidence of atrophy of the buccal fat pad within the area of the submalar triangle (Fig. 3*B*). The outline of the skin reveals a convex external surface indicating a youthful, robust fullness in the midfacial region.

Case 2

A 47-year-old woman expressed concerns related to gaunt hollow cheeks. Past removal of a large sebaceous cyst contributed to the depression in the area of the left cheek and collapse of the midfacial architecture. The submalar triangle can be discerned readily (Fig. 4*A*). MR imaging scan revealed only a moderate loss of buccal and subcutaneous fat on the right, as compared to a much greater loss on the left. These MR imaging findings corre-

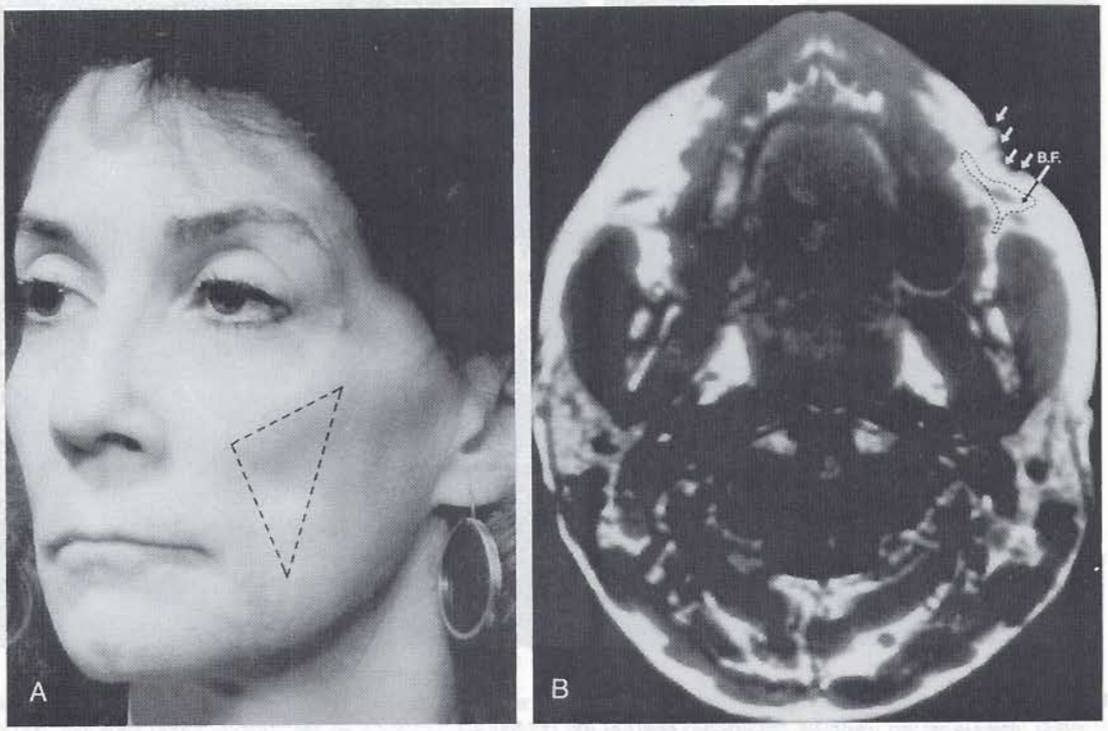

Figure 4. *A*, Case 2. Photograph of a 47-year-old woman with a gaunt appearance of the cheeks. The left cheek shows a greater loss of tissue with collapse of the skin localized to the area of the submalar triangle. *B*, Severe atrophy of buccal fat is seen (BF), with corresponding skin collapse *(arrows)*.

sponded directly to the clinical findings observed on physical examination (Fig. 4*B*).

Case 3

The 61-year-old white man (Fig. 5*A*) showed well-defined signs of atrophy within the right submalar triangle consistent with severe degeneration of soft tissues. The MR imaging study in Figure 5*B* reveals asymmetric facial loss of buccal fat that corresponds to the clinical picture (arrows).

Case 4

A 67-year-old white man with severe midfacial soft tissue degeneration, showing boundaries of the submalar triangle (Fig. 6*A*). MR imaging of this patient is shown in Figure 6*B*.

Case 5

A 33-year-old white woman presented with congenital facial lipodystrophy. MR images showed near total absence of subcutaneous fat around the face and head (Fig. 7*A*). It is readily apparent that there is absolutely no evidence of buccal or subcutaneous fat. Severe concavities found in the overlying facial profile are the result of the total absence of a supporting deep soft tissue substructure.

Magnetic resonance images taken initially after fat injection was performed revealed adequate facial contour in the area of the subma-

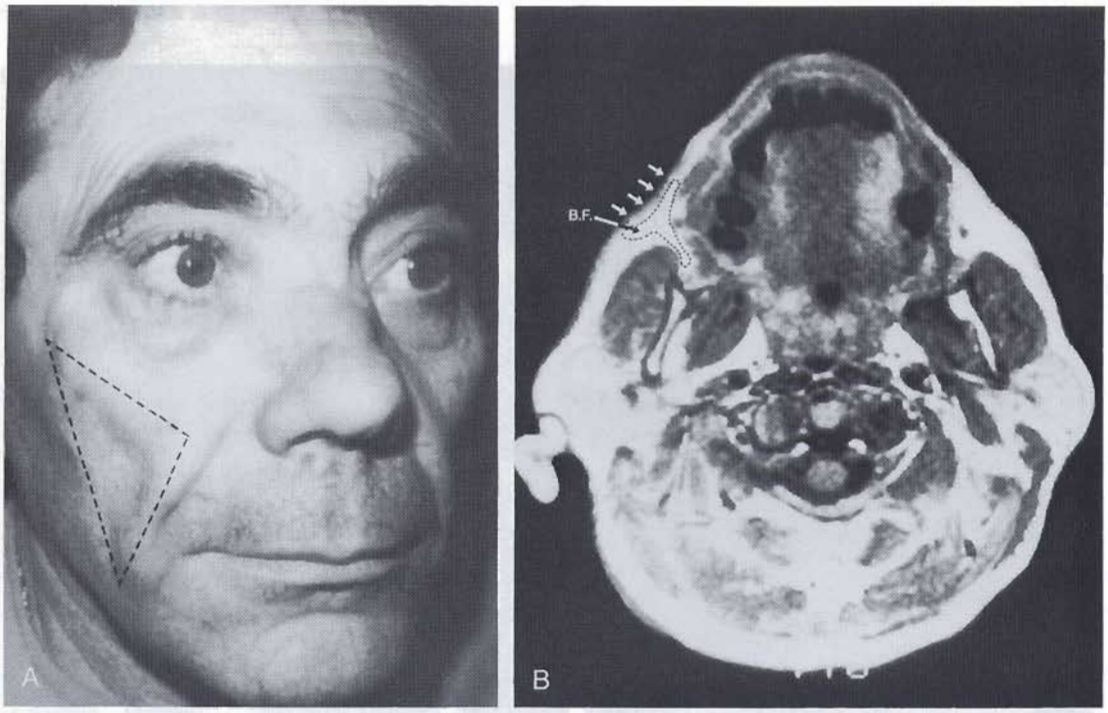

Figure 5. *A*, Case 3. A 61-year-old man with a midfacial depression localized to the right submalar triangle. *B*, The MR imaging findings of the midfacial depression seen in the photograph correlate to the findings found clinically. Arrows indicate the area of facial depression. BF = buccal fat pad.

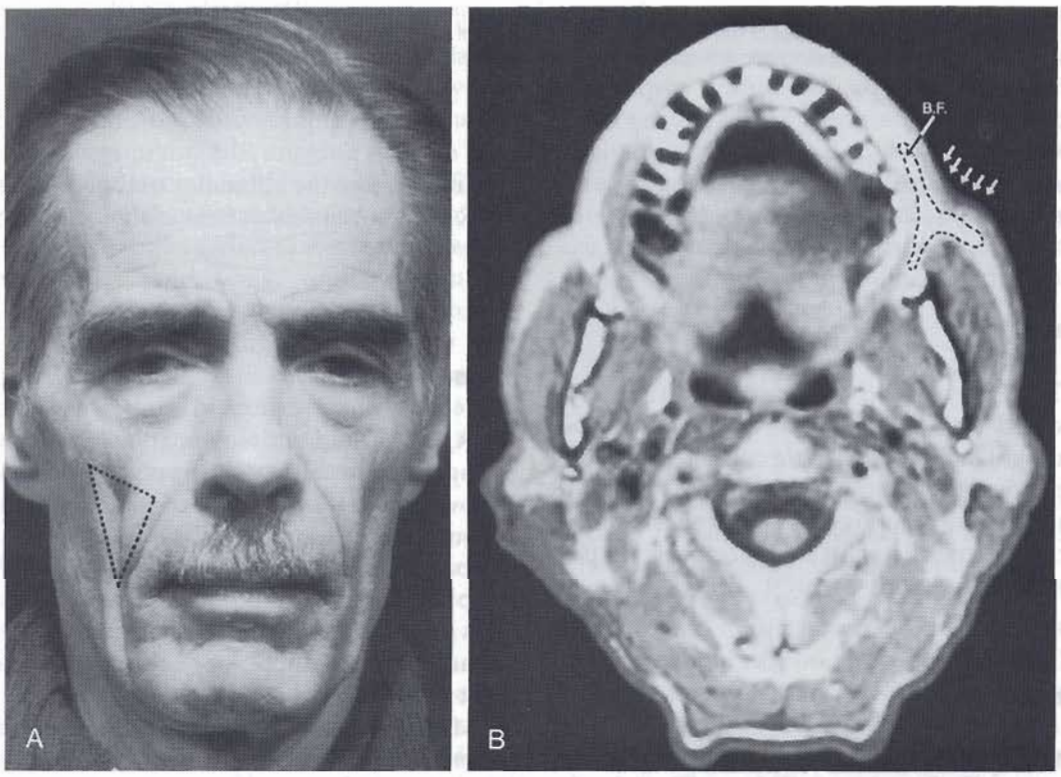

Figure 6. *A*, Case 4. A 67-year-old man with a midfacial depression localized to the right submalar triangle. *B*, The MR imaging findings of the midfacial depression seen in the photograph correlate to clinical findings. Arrows indicate area of facial depression.

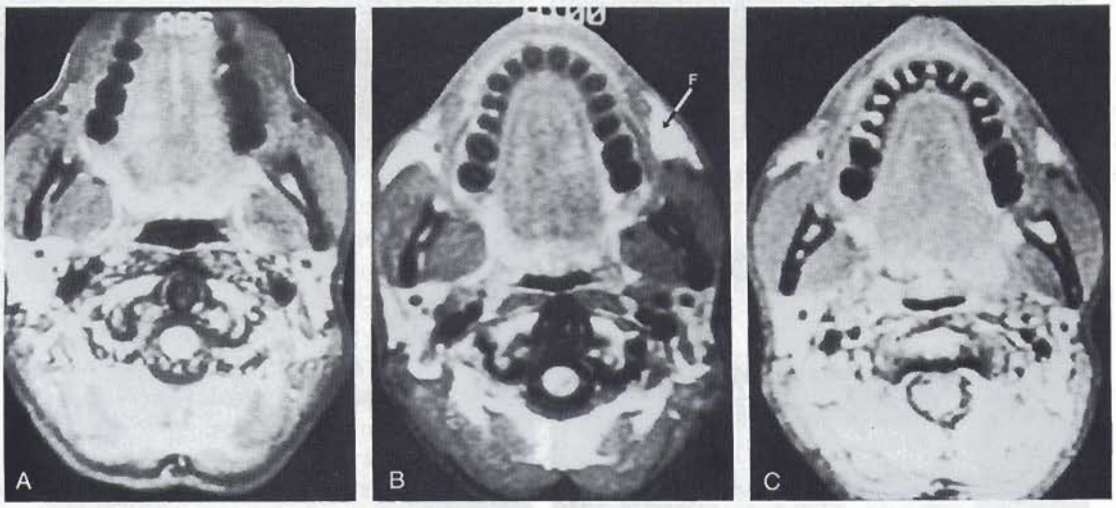

Figure 7. *A*, Case 5. MR image of a patient with congenital facial lipodystrophy. *B*, MR imaging immediately after fat injection. *C*, MR imaging of same patient 6 months after fat injection procedure. (*From* Davis, PL, Narayanan K, Liang M, et al: Magnetic resonance imaging of facial lipodystrophy. Am J Cosmetic Surg 6:249–251, 1989; with permission.).

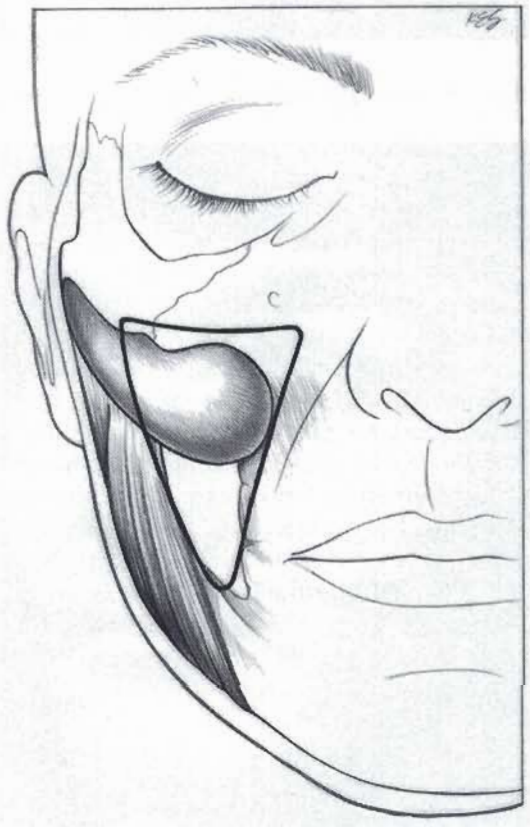

Figure 8. Relationship of the position of the submalar implant to the submalar triangle

lar triangle (Fig. 7*B*). However, 6 months later there was significant loss of this fact, with a return to the original concave facial contour (Fig. 7*C*).

DISCUSSION

The physiognomy of the face is a result of a dynamic balance between soft tissue, muscle, and bone.[11] The facial muscles intertwine with the subcutaneous and deep soft tissues to form a gridwork that provides a measure of support to the overlying skin. The buccal fat is a fundamental component of this system, and is exceptionally sensitive to changes resulting from weight loss, trauma, congenital predisposition, wasting disease, and most importantly, the process of aging.[5]

The dynamics of change in this system can be appreciated by MR imaging evaluation. The buccal fat occupies a cleft surrounded by relatively firm and stable tissues. Atrophy of this fat results in a predictable depression found within the midfacial area that we define as the submalar triangle. In this study we have used MR imaging as a new tool that allows us

Figure 9. *A*, Case 2. Photograph of female patient prior to surgery. *B*, Same patient following submalar augmentation.

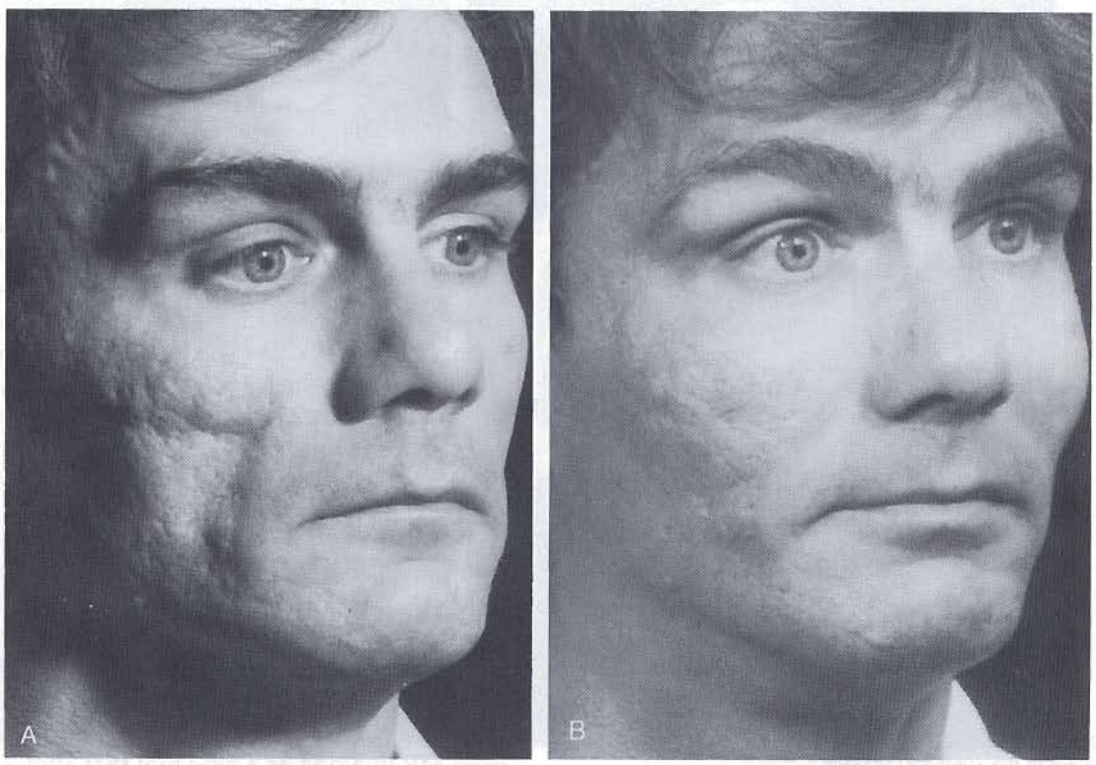

Figure 10. *A*, Photograph of male patient with well-defined submalar triangle. *B*, Same patient following submalar augmentation.

to observe the evolving changes in the fatty components of the midface.

The age-related degenerative changes found within the area of the submalar triangle are only one part of the degenerative process of aging. Changes also occur posterior to the submalar triangle and inferior to the zygomatic arch overlying the insertion of the masseter muscle. The combined loss in both the submalar triangle and infrazygomatic area give rise to a cadaver-like appearance.[4,13] Attempts to correct these deficiencies by fat transfer, liquid silicone injection, and free fascial grafting have proved less than successful.[5] The missing link, therefore, in facial rejuvenation surgery continues to be the inability to replace effectively this soft tissue component of the midfacial region.

Recently developed facial prostheses such as submalar and the never combined submalar-malar implants have given the surgeon a tool for effectively rehabilitating the inadequate structures of the midface by providing a support for the atrophic overlying soft tissues. The implant effectively mobilizes the soft tissue to a more superior location while providing expansion of the overlying skin in an anterolateral direction, thereby simulating its replacement.[2,3] Figure 8 illustrates the position of the submalar implant and its relationship to the submalar triangle. In Case 2 the postoperative result after submalar augmentation clearly demonstrates the successful restoration of contour in the area of the midface localized to the submalar triangle (Fig. 9*A* preoperative; Fig. 9*B* postoperative). Figure 10*A* shows a 35-year-old white man with well-defined submalar triangle. Note excellent correction of midfacial triangular depression as seen 1 year following surgery in Figure 10*B*.

CONCLUSION

By defining specific facial landmarks, the surgeon can better evaluate the necessity for midfacial contouring. The submalar triangle defines a key area affected by the ravages of time, and serves as a signpost for more effective facial rejuvenation surgery.

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Guest Editors' Comments

The art of facial contouring implies visualizing acquired or hereditary defects of the face that can be corrected through the use of various facial implants. The specific orienta-

tion to the submalar triangle has been studied by Drs. Tobias and Binder who have demonstrated the radiographic changes that can be correlated to actual volumetric soft-tissue and external contour changes in this specific area. The importance of submalar deficiencies is emphasized as it relates to the removal of fat. In patients undergoing buccal fat removal, one must anticipate the natural aging process and subsequent loss of fatty tissue in this area.

This article stresses the importance of understanding the significance of the subcutaneous tissue, the deep fat contained within the confines of the submalar triangle, and the bony architectural components of this area. The sophisticated facial plastic surgeon will then anticipate not only remodeling the area but augmenting it and changing it in a way that will be in the best interests of the patient for the long term.