

The Extended SMAS Facelift

Identifying the Lateral Zygomaticus Major Muscle Border Using Bony Anatomic Landmarks

Arian Mowlavi, MD, and Bradon J. Wilhelmi, MD

Abstract: Extended superficial musculoaponeurotic system (SMAS) rhytidectomy has been advocated for improving nasolabial fold prominence. Extended subSMAS dissection requires release of the SMAS typically from the upper lateral border of the zygomaticus major muscle and continued dissection medial to this muscle. This maneuver releases the zygomatic retaining ligaments and achieves more effective mobilization and elevation of the ptotic malar soft tissues, resulting in more dramatic effacement of the nasolabial crease. Despite its presumed advantages, few reports have suggested greater risk of nerve injury with this technique compared with other limited sub-SMAS dissection techniques. Although the caudal extent of the zygomaticus muscle insertion to the modiolus of the mouth has been well delineated, the more cephalad origin has been vaguely defined. We attempted to define anatomic landmarks which could serve to more reliably identify the upper extent of the lateral zygomaticus major muscle border and more safely guide extended sub-SMAS dissections. Bilateral zygomaticus major muscles were identified in 13 cadaver heads with 4.0-power loupe magnification. Bony anatomic landmarks were identified that would predict the location of the lateral border of the zygomaticus major muscle. The upper extent of the lateral border of the zygomaticus major muscle was defined in relation to an oblique line extending from the mental protuberance to the notch defined at the most anterior-inferior aspect of the temporal fossa at the junction of the frontal process and temporal process of the zygomatic bone. The lateral border of the zygomaticus major muscle was observed 4.4 ± 2.2 mm lateral and parallel to this line. More accurate prediction of the location of the upper extent of the lateral border of the zygomaticus major muscle using the above bony anatomic landmarks may limit nerve injury during SMAS dissections in extended SMAS rhytidectomy.

(*Ann Plast Surg* 2004;52: 353–357)

Received June 9, 2003 and accepted for publication August 22, 2003.

From the Plastic Surgery Institute, Southern Illinois University, School of Medicine, Springfield, IL.

Reprints: Bradon J. Wilhelmi, MD, Assistant Professor, The Plastic Surgery Institute, Southern Illinois University, School of Medicine, 747 N. Rutledge, P.O. Box 19653, Springfield, IL 62794–9653. E-mail: bwilhelmi@siumed.edu

Copyright © 2004 by Lippincott Williams & Wilkins

ISSN: 0148-7043/04/5204-0353

DOI: 10.1097/01.sap.0000099712.80882.6b

In the early 1980s, improving the nasolabial fold prominence by elevation of the malar soft tissue ptosis was introduced. Skoog¹ had advocated a superficial musculoaponeurotic system (SMAS) component to the facial skin flap, thus introducing composite tissue flap elevation to rhytidectomy. Additionally, a biplanar face lift technique had been developed, utilizing independent SMAS and cutaneous flaps.² This technique intended to allow more aggressive traction of central facial tissue by the SMAS but without the resulting “pulled” effect typically observed on the overlying skin. Next, skin flaps were extended medially across to the nasolabial fold in an attempt to increase effacement of the nasolabial crease.³ Despite these maneuvers, nasolabial fullness was observed to persist or recur prematurely. Finally, modifications to the biplanar technique, such as the extended SMAS technique, evolved following delineation of the medial SMAS anatomy.⁴

Several anatomic studies followed Skoog’s initial introduction of the SMAS and its suspension within the skin flap.¹ Mitz and Peyronie⁵ provided the first detailed anatomic studies of this fascial layer. Nearly a decade later, Wasef⁴ reaffirmed the medial attachment of the SMAS to the zygomaticus major muscle. Finally, Barton⁶ differentiated the superficial and deep SMAS layers surrounding the zygomaticus major muscle and discussed its implications. Since the SMAS fascia surrounded the zygomaticus major muscle, lateral pull on the SMAS produced limited excursion of the soft tissue overlying the central face. This limitation was due to zygomaticus major muscle’s underlying deep tissue attachments, especially at its unyielding cephalad origin.⁶ In fact, several clinicians argued that lateral traction on the SMAS would be transmitted to a pull on the zygomaticus major muscle, and paradoxically, only serve to deepen the nasolabial fold.³ Extended SMAS techniques developed following anatomic delineations of the medial SMAS extension as well as the nasolabial fold and crease.^{7,8}

In 1987, Millard attributed the prominence of nasolabial crease to its adjacent lateral fullness due to accumulation of subcutaneous fat.⁹ This accumulation of subcutaneous fat

pad was subsequently recognized as descent of the malar fat pad from its original position overlying the zygomatic buttress.¹⁰ In summary, the nasolabial crease gained prominence as a result of nasolabial fold accumulation of ptotic malar fat pad. The malar fat pad was described as a triangular area of bulky subcutaneous fat overlying the maxillary zygomatic region with its base at the nasolabial fold and its apex at the infraorbital fibers of the orbicularis oculi muscles.¹¹ The SMAS-mimetic muscle layer was described as maintaining dermal attachments to the nasolabial crease, which rendered it more prominent with muscle animation such as smiling.¹² Moreover, Mendelson demonstrated zygomaticus major muscle fiber insertions medial to the nasolabial crease at the modiolus. Thus, simple lateral traction of the SMAS was discouraged since it was felt to exaggerate the nasolabial fold by pulling the nasolabial crease beneath the fold.¹³ This conclusion was further substantiated by the fact that the nasolabial fold disappeared in cases of facial paralysis.¹²

During the latter part of the 1980s and the early 1990s, several clinicians advocated more extensive dissection of the SMAS medial to the zygomaticus major muscle to gain more controlled traction on the central facial area and more effective effacement of the nasolabial crease.¹³⁻¹⁷ However, the benefits observed on nasolabial crease effacement needed to be weighed against its complications. Specifically, various modifications of the extended SMAS were reported to be associated with increased risk of transient facial nerve paresis. Mendelson¹³ reported several cases of transient mild weakness with closure of the eyelid on blinking, as well as weakness of the upper lip; included in this retrospective report of 135 cases were 3 prolonged cases of paresis. Barton¹⁴ reported a single case of transient upper lip weakness in his retrospective review of 100 cases. Hamra¹⁵ described 2 cases of upper lip weakness which resolved after 3 weeks in his retrospective review of 403 cases. Finally, Owsley¹⁷ reported that few patients demonstrated temporary mild decreased levator function characterized by restricted lip elevation which cleared over 2 to 3 weeks; he attributed these symptoms to increased swelling in his retrospective review of 400 cases.

All of the described extended SMAS techniques require release of the SMAS fibers spanning the upper lateral border of the zygomaticus major muscle, followed by continued dissection medial to this muscle. This release and subsequent medial dissection, unique to extended SMAS rhytidectomy, may be associated with increased risk of facial nerve injuries. In an attempt to minimize the increased risk of injury to the facial nerve, the upper lateral border of the zygomaticus major was defined using bony anatomic landmarks. Although the caudal extent of the zygomaticus muscle insertion to the modiolus of the mouth has been well delineated, the origin and more cephalad extent has been vaguely defined.¹⁸ We attempted to define anatomic landmarks which could serve to

more reliably identify the upper extent of the lateral zygomaticus border and more safely guide extended SMAS dissections.

MATERIALS AND METHODS

Thirteen cadaver heads were dissected using a standard rhytidectomy skin incision and skin and/or SMAS flaps elevated medially until the junction of the SMAS and zygomaticus major lateral border was identified. Bony anatomic landmarks were identified that were easily palpable and that would predict the location of the lateral border of the zygomaticus major muscle. The lateral border of the zygomaticus major muscle was defined with respect to the bony landmarks using 4.0 loupe magnification and surgical calipers. (Fig. 1 and 2)

RESULTS

The zygomaticus major muscle was present in all cadaver heads examined. The upper extent of the lateral border of the zygomaticus major muscle was defined in relation to an oblique line extending from the mental protuberance to the

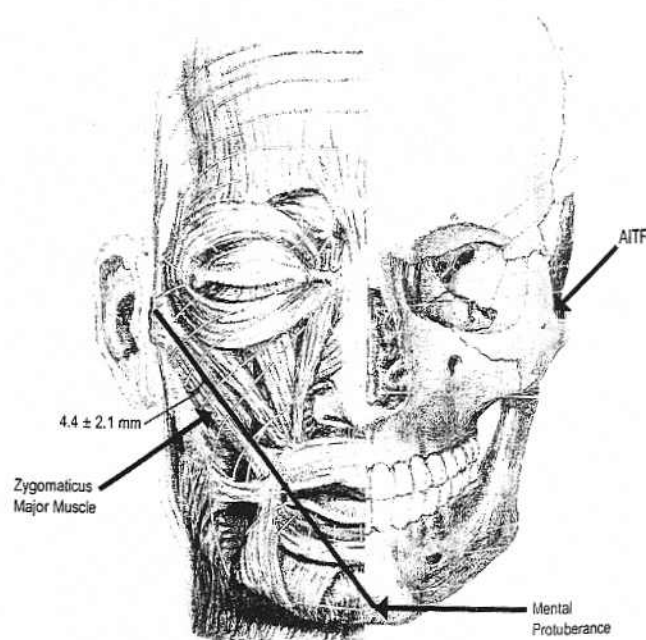


FIGURE 1. The upper extent of the lateral border of the zygomaticus major muscle was defined in relation to an oblique line extending from the mental protuberance to the notch defined at the most anterior-inferior aspect of the temporal fossa at the junction of the frontal process and temporal process of the zygomatic bone. The lateral border of the zygomaticus major muscle was observed on average 4.4 ± 2.2 mm lateral and parallel to this line.

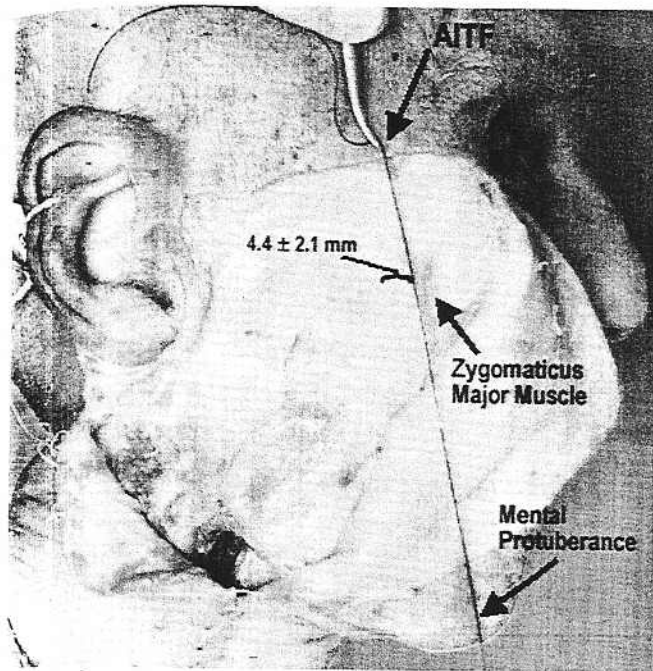


FIGURE 2. This illustration of a cadaver head demonstrates the zygomaticus major muscle and its relation to the oblique line extending from the mental protuberance to the notch defined at the most anterior-inferior aspect of the temporal fossa (AITF) at the junction of the frontal process and temporal process of the zygomatic bone. The lateral border of the zygomaticus major muscle was observed on average 4.4 ± 2.2 mm lateral and parallel to this line.

notch defined at the most anterior-inferior aspect of the temporal fossa at the junction of the frontal process and temporal process of the zygomatic bone (Figs. 1 and 2). The lateral border of the zygomaticus major muscle was observed 4.4 ± 2.2 mm lateral and parallel to this line (Figs. 1 and 2).

DISCUSSION

Although various extended SMAS techniques have been described, all encompass release of the retaining ligaments¹⁹ and extended dissection of the SMAS beyond the lateral border of the zygomaticus major muscle.¹³⁻¹⁷ Dissection medial to this muscle presumably results in improved traction of SMAS on the medial soft tissue elements since its mobility is no longer limited by adherence to the zygomaticus major muscle. Medial dissection in a sub-SMAS plane was performed by remaining just deep to the anterior SMAS fascial layer (just overlying the zygomaticus major muscle fibers).²⁰ Owsley supported this deeper plane of dissection since it created a release of the malar fat pad from the superficial mimetic muscle fibers, ensuring improved traction on the malar fat pad.²¹ Furthermore, Stuzin et al¹⁶ emphasized limiting subcutaneous dissection to several centimeters lateral

to the nasolabial fold in the direction of the alar crease to maintain the anterior SMAS fascia and skin attachments, thus improving the posterior-lateral pull on the malar fat pad and effacement of the nasolabial fold.

Stuzin most aggressively reiterated the need for incising the zygomatic and masseteric retaining ligaments, in addition to the release of the SMAS from the lateral border of the zygomaticus major muscle to achieve adequate pull on the nasolabial fold. Retaining ligaments of the cheek were first described by Furnas.²² The zygomatic ligaments, fibrous septa which attach the periosteum to the dermis, extend from the junction of the zygomatic arch and body, throughout the malar fat pad, and up to the most medial portion of the zygoma just medial to the zygomatic major muscle. Stuzin stressed that the extended SMAS required release of the entire retaining ligament chain including the most medial, stout, zygomatic ligament.²⁰ The second set of ligaments, termed the masseteric cutaneous ligaments, bordered the anterior border of the masseter muscle and provided support to the medial cheek.²¹ Only after release of both of these "anchors" did the ptotic malar soft tissue reposition over the zygomatic buttress and provide improvement in nasolabial fold prominence.²³

Inevitably, the benefits of the extended SMAS must be weighed against its increased propensity for complications. Transient paresis of the lower eyelid muscles as well as the upper lip elevators has been documented.¹³⁻¹⁷ The orbicularis oculi innervation is partially supplied by zygomatic branches of facial nerve which cross over the upper third belly of the zygomaticus major muscle.²⁴ This anterior crossover has been postulated to be a source of nerve injury during initial medial SMAS dissection at the origin and the upper lateral border of the zygomaticus major muscle.²⁴ Although most zygomatic branches travel posterior to the zygomaticus major muscle, some motor nerves may pass superficial to the this muscle, contributing a rich plexiform innervation to the more superficially lying orbicularis oculi muscle.^{24,25} Fortunately, due to the plexiform nature of the orbicularis oculi muscle innervation, these nerves may often be disrupted without any functional impairment.²⁵ Analogous propensity for injury to the upper lip nerves has been postulated. These facial nerves lie under the masseteric fascia, or deep fascia as described by Stuzin.¹⁶ However, this layer can be of variable thickness and as one approaches the medial cheek (malar area), the nerves may lie more superficial along surface of buccal fat and in proximity to the sub-SMAS. Differentiation of the retaining ligaments from terminal motor nerve branches can be difficult and may require cautious blunt vertical spreading.²⁵ Moreover, in approximately 5% of patients the zygomatic nerve branches may penetrate the deeper fascial layer a few centimeters lateral to the zygomaticus major muscle and thus lie in the immediate sub-SMAS layer and be prone to injury. In such cases, it is even more difficult to delineate the nerves on

their path to the upper lip elevators from the retaining ligaments that must be severed.²¹ Additionally, the nerves innervating the zygomaticus major muscle may penetrate the deep SMAS layer more laterally and be prone to injury following release of the SMAS in transition from the sub-SMAS to supramuscle (prezygomaticus major) plane. In conclusion, it is hypothesized that more reliable prediction of the location of the lateral border of the zygomaticus major muscle may limit such nerve injury.

To date, the zygomaticus major muscle insertion has been well delineated. All of the upper lip mimetic muscles typically insert at the modiolus with moderate degree of variation.²⁶ Specifically, the modiolus is formed by the superficial fibers of the zygomaticus major, deep fibers of the levator anguli oris, and medial fibers of the buccinator.²⁴ Although certain facial muscles such as the zygomaticus minor and risorius appear variably, the zygomaticus major and levator labii superioris are consistently identified.¹⁸ A cadaveric study of 50 head dissections revealed that the insertion pattern of the zygomaticus major muscle varied as characterized by a incidence of single slip insertion in 66% of muscles as compared with double slip insertion (bifid) in 34% of muscles.¹⁸ In all muscles, the cephalad extension of the zygomaticus muscle contained a single slip origin (Fig. 2).¹⁸

While the zygomaticus major muscle insertion has been well delineated, the origin has been inconsistently described. The zygomaticus major has been described as originating in front of the zygomaticotemporal suture where it is covered by the orbicularis oculi fibers.²⁴ Mendelson¹³ described the origin by "a vertical line dropped from the lateral orbital rim to the lower border of the zygoma." Specifically, the origin of the zygomaticus major was depicted on this line and 1 cm above the lower border of the zygoma. Yet another clinician described the zygomaticus major muscle originating from the malar bone on a line drawn from the lateral canthus to the angle of the mandible.²⁵ Finally, Furnas²² described the origin to be located along the zygomatic body and coursing towards its insertion at the modiolus labii. Undoubtedly, the origin of the zygomaticus major muscle is covered by the most caudal orbicularis fibers, thus making its palpation difficult.¹⁷ Furthermore, the origin as previously described, does not offer bony anatomic landmarks that are easily differentiable and palpable. Finally, these landmarks only define a single point of muscle origin and do not describe the muscle course.

Regardless of which extended SMAS technique is used, medial SMAS dissection is initiated with the release of the SMAS typically at the upper lateral zygomaticus major muscle border. Mendelson¹³ described starting SMAS dissection over the lower orbicularis oculi fibers and finding the oblique oriented fibers of zygomaticus major at 5 cm anterior to the tragus. We felt that defining the zygomaticus major lateral

border along its entire cephalad length would be more beneficial than a single point identification. It was hoped that predicting the location of this lateral border preoperatively using palpable bony anatomic landmarks would potentially minimize nerve injury. Also, the SMAS fascia tends to become thinner as it spans medially over the zygomaticus major muscle.¹⁶ Our findings could help more cautious dissection of the SMAS when nearing the zygomaticus major muscle so that this fascial layer does not tear. Additionally, Stuzin et al²¹ recommended limiting the subcutaneous skin flap dissection to a few centimeters lateral of the nasolabial fold to maximize skin-SMAS overlap and optimize SMAS traction on the medial skin and malar fat pad. By predicting the lateral border of the zygomaticus major muscle, the subcutaneous dissection could be limited to the lateral border of the zygomaticus major muscle, thus preserving the skin-SMAS overlap, especially over this region of SMAS thinning.

We have identified palpable bony anatomic landmarks, which include the mental protuberance and the most anterior inferior temporal fossa notch at the junction of the frontal process and temporal process of the zygomatic bone, to more reliably predict the location of the upper cephalic extension of the lateral zygomaticus major muscle border. More accurate prediction of the lateral border of the zygomaticus major muscle, which courses 4.4 ± 2.2 mm lateral and parallel to the oblique line spanning the above landmarks, is hoped to prevent complications and improve outcomes following extended SMAS rhytidectomy.

REFERENCES

1. Skoog T. *Plastic Surgery: New Methods*. Philadelphia: Saunders; 1974.
2. Duffy MJ, Friedland JA. The superficial plane rhytidectomy revisited. *Plast Reconstr Surg*. 1994;93:1392.
3. Teimourian B, Delia S, Wahrman A. The multiplane face lift. *Plast Reconstr Surg*. 1994;93:78.
4. Wassef M. Superficial fascial and muscular layers in the face and neck: a histological study. *Aesthetic Plast Surg*. 1987;11:171.
5. Mitz V, Peyronie M. The superficial musculoaponeurotic system (SMAS) in the parotid and cheek area. *Plast Reconstr Surg*. 1976;58:80.
6. Barton FE. The SMAS and the nasolabial fold. *Plast Reconstr Surg*. 1992;89:1054.
7. Owsley JQ. SMA. S-platysma face lift. *Plast Reconstr Surg*. 1983;71:573.
8. Ruess W, Owsley JQ. The anatomy of the skin and fascial layers of the face in aesthetic surgery. *Clin Plast Surg*. 1987;14:677.
9. Millard DR, Yuan RT, Devine JW. A challenge to the undefeated nasolabial folds. *Plast Reconstr Surg*. 1987;80:37.
10. Yousif NJ, Gosain AK, Matloub HS, et al. The nasolabial fold: an anatomic and histologic reappraisal. *Plast Reconstr Surg*. 1994;93:60.
11. Owsley JQ. Lifting the malar fat pad for correction of prominent nasolabial folds. *Plast Reconstr Surg*. 1993;91:463.
12. Rubin LR, Mishriki Y, Lee G. Anatomy of the nasolabial fold: the keystone of the smiling mechanism. *Plast Reconstr Surg*. 1989;83:1.
13. Mendelson BC. Correction of the nasolabial fold: extended SMAS dissection with periosteal fixation. 1992;89:822.
14. Barton FE. Rhytidectomy and the nasolabial fold. *Plast Reconstr Surg*. 1992;90:601.
15. Hamra ST. The deep-plane rhytidectomy. *Plast Reconstr Surg*. 1990;86:53.
16. Stuzin JM, Baker TJ, Gordon HL. The relationship of the superficial and

deep facial fascias: relevance to rhytidectomy and aging. *Plast Reconstr Surg.* 1992;89:441.

17. Owsley JQ. Lifting the malar fat pad for correction of prominent nasolabial folds. *Plast Reconstr Surg.* 1992;91:463.
18. Pessa JE, Zadoo VP, Adrian EK, et al. Variability of the midfacial muscles: analysis of 50 hemifacial cadaver dissections. *Plast Reconstr Surg.* 1998;102:1888.
19. Furnas DW. Strategies for nasolabial levitation. *Clin Plast Surg.* 1995; 22:265.
20. Owsley JQ. Face lift. *Plast Reconstr Surg.* 1997;100:514.
21. Stuzin JM, Baker TJ, Gordon HL, et al. Extended SMAS dissection as an approach to midface rejuvenation. *Clin Plast Surg.* 1995;22: 295.
22. Furnas DW. The retaining ligaments of the cheek. *Plast Reconstr Surg.* 1989;83:11.
23. Baker TJ, Stuzin JM. Personal technique of face lifting. *Plast Reconstr Surg.* 1997;100:502.
24. Freilinger G, Gruber H, Happak W, et al. Surgical anatomy of the mimic muscle system and the facial nerve: importance for reconstructive and aesthetic surgery. *Plast Reconstr Surg.* 1986;80:686.
25. Tremolada C, Fisette J, Candiani P. Anatomical basis for a safe and easier approach to composite rhytidectomy. *Aesth Plast Surg.* 1994;18: 387.
26. Greyling LM, Meiring JH. Morphological study on the convergence of the facial muscles at the angle of the mouth. *Acta Anat.* 1992;143: 127.

e ben-
d that
tively
ntially
ids to
taticus
is dis-
major
nally,
s skin
labial
SMAS
lifting
e, the
order
skin-
thin-

marks,
terior
rontal
more
ion of
curate
major
llet to
g ex-

; 1974.
visited.

. *Plast*

l neck:

system
58:80.
Surg.

1:573.
of the

feated

ld: an
3:60.
ninent

d: the
3:1.
SMAS

Surg.

86:53.
al and

ilkins