

The Subzygomatic Fossa

A Practical Landmark in Identifying the Zygomaticus Major Muscle

Philip J. Miller, MD; Sarah Smith, MD; Anil Shah, MD

Objective: To test the validity of the subzygomatic fossa as a possible landmark in identifying the origin of the zygomaticus major muscle (ZMM).

Methods: Twenty-three fresh cadaver facial halves were dissected. Four reference points were identified in each cadaver head: the zygomatic arch, the malar eminence, the modiolus, and the ZMM insertion notch. The ZMM insertion notch is a palpable landmark that is typically identified midway between the zygomatic arch and the malar eminence. A straight line was drawn from the ZMM insertion notch to the modiolus. An additional line was drawn from the malar eminence to the modiolus. An incision was made along each line to the depth of the

facial muscles. The presence or absence of the ZMM was recorded, and the location of the ZMM insertion notch was characterized in each cadaver.

Results: The ZMM insertion notch was palpated and identified in 23 of 23 facial halves. It was accurate in identifying the course of the ZMM in all 23 facial halves. The line created by the malar eminence to the modiolus was inaccurate in all 23 facial halves.

Conclusion: The ZMM insertion notch is a reliable landmark for identification of the ZMM.

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THE IDENTIFICATION OF THE course of the zygomaticus major muscle (ZMM) plays an important role in facial plastic surgery. First of all, the ZMM serves as an important landmark in deep plane rhytidectomy.¹ The facial nerve courses deep to the plane of the ZMM, providing the face-lift surgeon with a reliable guide to dissection into the medial portion of the face.^{1,2} Also, some surgeons report plication of the ZMM to provide rejuvenation of the aged face.^{3,4} For patients receiving botulinum toxin type A (Botox) injections for “crow’s feet” within the orbicularis oculi, avoidance of the ZMM is critical to prevent the unwanted sequelae of a lip drop.⁵

The ZMM is responsible for lifting the corners of the mouth, which serves several expressive purposes, including smiling. It is typically a fan-shaped muscle, which may be single headed or bifid in nature.⁶ The muscle increases in size and thickness in males and in patients with an increasing body mass index.⁷ Located anterior to the ZMM is the zygomatic cutaneous ligament, or MacGregor’s patch.⁸ Release of this ligament is crucial in providing mobilization of the malar fat pad and re-

juvenation of the midface structures. The superficial musculoaponeurotic system layer can be mobilized further and with less tension with release of the zygomatic ligament.² A backcut of the ZMM itself will also provide improved mobilization of the superficial musculoaponeurotic system layer.⁴

Deep to the ZMM lies the plexus of the zygomatic branch of the facial nerve. The orbicularis oculi may be partially innervated in certain patients by some nerve branches that lie superficial to the ZMM.⁹ However, the plexiform innervation of the zygomatic branch of the facial nerve and the vast majority of nerves that lie deep to the ZMM make permanent sequelae unlikely. The ZMM, along with the other upper lip mimetic muscles, inserts at the modiolus.¹⁰ The ZMM originates anterior to the zygomatic temporal suture within the subzygomatic fossa¹¹ (**Figure 1**).

Despite this anatomical description, surgeons have sought complex means of ascertaining the clinical origin of the ZMM (**Figures 1, 2, 3, and 4**). Mendelson¹² described the origin as “a vertical line dropped from the lateral orbital rim to the lower border of the zygoma.” Tremolada et al¹³ described the origin from the ma-

Author Affiliations: Division of Facial Plastic Surgery, Department of Otolaryngology, New York University School of Medicine, New York, New York.

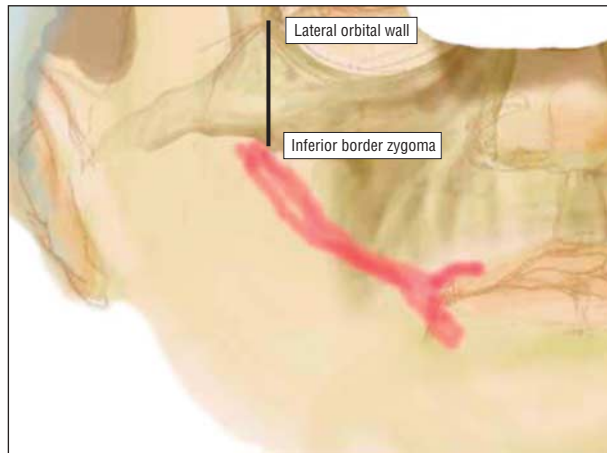


Figure 1. The zygomaticus major muscle is found by dropping a vertical line from the lateral border of the orbital rim to the inferior border of the zygoma (adapted from Mendelson¹²).

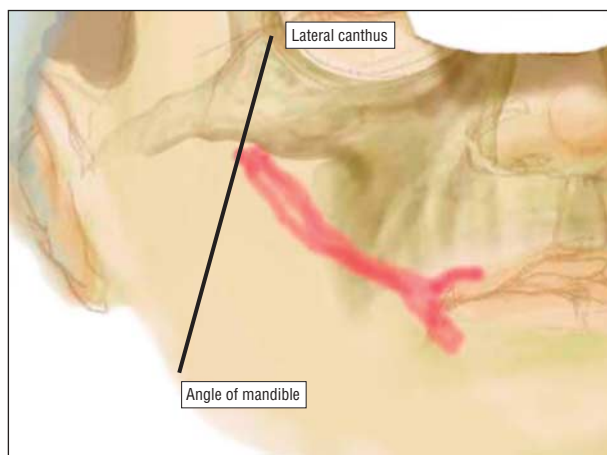


Figure 2. The zygomaticus major muscle originates from the malar bone on a line drawn from the lateral canthus to the mandible (adapted from Tremolada et al¹³).

lar bone on a line drawn from the lateral canthus to the mandible. Furnas⁸ reported that the ZMM was located along the zygomatic body, coursing to the modiolus. In a more recent article, Mowlavi and Wilhelmi¹⁴ found that the lateral border of the ZMM was 4.4 mm lateral and parallel to an oblique line drawn from the mental protuberance to the notch defined as the most anterior-inferior aspect of the temporal fossa at the junction of the frontal process and the temporal process of the zygoma. Finally, Spiegel and DeRosa⁵ published an anatomical article in which they describe the origin of the ZMM to be 1.4 cm inferior to the Frankfort horizontal line at 1.0 cm lateral to the lateral canthus.

While the previous descriptions were fairly accurate in illustrating the course of the ZMM, their overall complexity has prevented them from being universally adopted by facial plastic surgeons. The origin of the ZMM is the subzygomatic fossa, which is located posterior and inferior to the malar eminence and anterior to the zygomatic temporal suture. Despite some contrary reports, the subzygomatic fossa is an easily palpable landmark. The senior author (P.J.M.) has developed a technique for locating the course of the ZMM (**Figure 5**). By using

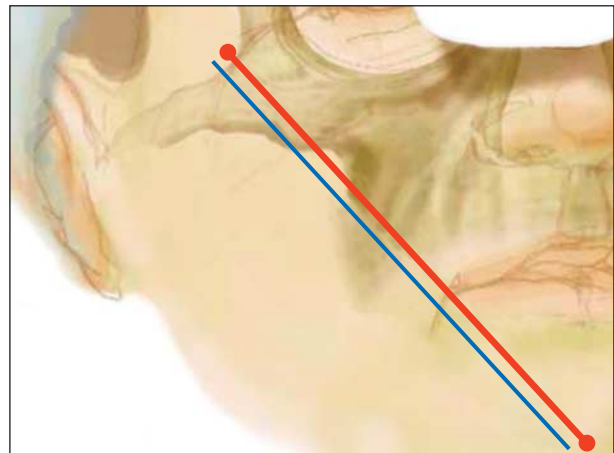


Figure 3. The lateral border of the zygomaticus major muscle was found 4.4 mm lateral and parallel to an oblique line drawn from the mental protuberance to the notch defined as the most anterior-inferior aspect of the temporal fossa at the junction of the frontal process and temporal process of the zygoma (adapted from Mowlavi and Wilhelmi¹⁴).

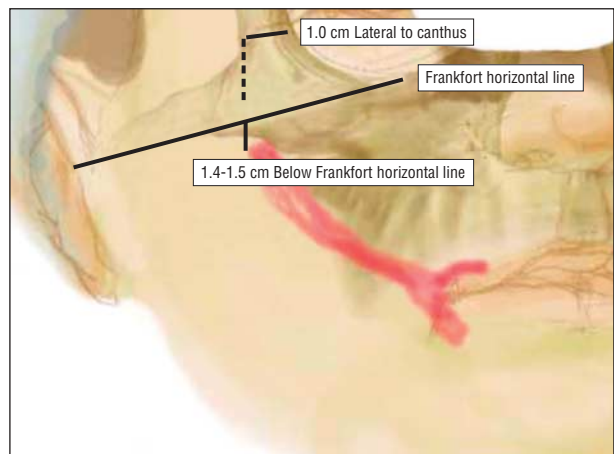


Figure 4. The zygomaticus major muscle originates 1.4 cm inferior to the Frankfort horizontal line at 1.0 cm lateral to the lateral canthus (adapted from Spiegel and DeRosa⁵).

the palpable subzygomatic fossa itself, the location of the ZMM can be ascertained.

METHODS

Twenty-three fresh cadaver facial halves were dissected. Four reference points were identified in each cadaver head: the zygomatic arch, the malar eminence, the modiolus, and the subzygomatic fossa, which is a palpable landmark that can be identified midway between the zygomatic temporal suture and the malar eminence. A straight line was drawn from the ZMM insertion notch to the modiolus. An additional line was drawn from the malar eminence to the modiolus. An incision was made along the each line to the depth of the facial muscles. The presence or absence of the ZMM was recorded when each of the above landmarks was used (**Figure 6**). The palpation of the landmarks was performed by a junior resident (S.S.) to ensure that novice surgeons could easily learn to use this technique. The clinical application of the efficacy of the zygomatic notch was applied in 28 consecutive deep-plane rhytidectomies. The zygomatic notch, as well as the modiolus and the proposed location of the ZMM, was identified and marked before the face-

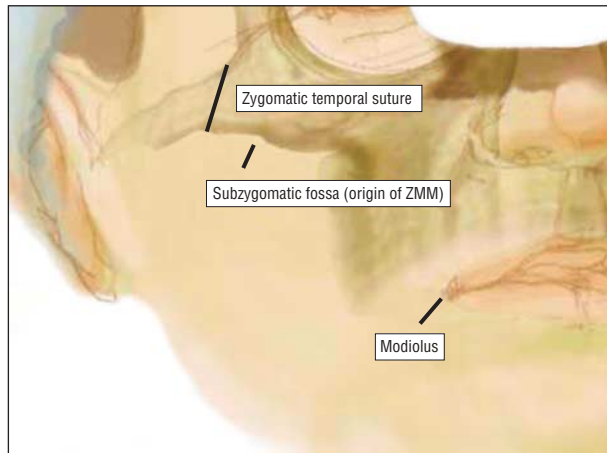


Figure 5. The subzygomatic fossa is located posterior and inferior to the malar eminence and anterior to the zygomatic temporal suture (adapted from Mowlavi and Wilhelmi¹⁴). ZMM indicates zygomaticus major muscle.

lift. A deep-plane rhytidectomy was performed with location of the ZMM using the external landmark as a guide.

RESULTS

The subzygomatic fossa was palpated and identified in 23 of 23 facial halves. The ZMM insertion notch was also accurate in identifying the course of the ZMM in all 23 facial halves. The line created by the malar eminence to the modiolus was inaccurate in all 23 facial halves. Clinically, the location of the subzygomatic fossa correlated well with the location of the ZMM in 58 consecutive rhytidectomy procedures.

COMMENT

We found the subzygomatic fossa to be an easily palpable landmark. Because the subzygomatic fossa is the recognized origin of the ZMM in several textbooks and anatomy books, we chose to use it as the landmark rather than a tangential correlation. We found both the palpability of the subzygomatic fossa and its underlying relationship with the origin of the ZMM to be highly accurate. Molwavi and Wilhelmi¹⁴ found the subzygomatic fossa difficult to palpate. However, we found that, by clearly palpating and identifying the zygomatic arch and the malar eminence, the subzygomatic fossa could be easily palpated. As a testament to its ease, a junior resident (S.S.) was able to palpate the fossa in each cadaver case. Landmarks are useful in surgery to provide the surgeon with an appropriate reference to the surrounding structures. A landmark must be accurate and identifiable to be useful. The use of the ZMM as a landmark in deep-plane rhytidectomy has been limited by lengthy descriptions on the origin of this muscle. The subzygomatic fossa simplifies its location and allows ease of identification.

Minimizing complications in such procedures as botulinum toxin injections are crucial to providing optimal patient results. Paralysis of the ZMM has been reported as an inadvertent adverse effect of treating periorbital rhytids.¹⁵ Limiting the dilution content of botulinum toxin,



Figure 6. Cadaver demonstrating the zygomatic arch, subzygomatic fossa, and malar eminence marked before dissection. The zygomaticus major muscle can be seen coursing from the subzygomatic fossa to the modiolus.

experience with injection, and knowledge of the facial anatomy will limit the possibility of this potential sequela occurring. Knowledge of the course of the ZMM will reduce the likelihood of an inadvertent injection.

Extensive knowledge of anatomy is required for safe performance of the deep-plane face-lift, and the ZMM is an important landmark for a safe and effective procedure. We hope that the identification of this landmark muscle will provide improved safety in deep-plane rhytidectomy.

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Correspondence: Anil Shah, MD, New York University, 530 First Ave, Suite 7U, New York, NY 10016 (shaha05@med.nyu.edu).

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REFERENCES

1. Hamra ST. The deep-plane rhytidectomy. *Plast Reconstr Surg.* 1990;86(1):53-61.
2. Owsley JQ. Lifting the malar fat pad for correction of prominent nasolabial folds. *Plast Reconstr Surg.* 1993;91(3):463-474.
3. Fayman MS, Potgieter E. Zygomaticus major advancement as an adjunct to lower blepharoplasty. *Aesthetic Plast Surg.* 2002;26(1):26-30.

4. Mentz HA, Ruiz-Razura A, Patronella CK, Newall G. Facelift: measurement of superficial muscular aponeurotic system advancement with or without zygomatic major release. *Aesthetic Plast Surg.* 2005;29(5):353-362.
5. Spiegel JH, DeRosa J. The anatomical relationship between the orbicularis oculi muscle and the levator labii superioris and zygomaticus muscle complexes. *Plast Reconstr Surg.* 2005;116(7):1937-1942.
6. Pessa JE, Zadoo VP, Garza PA, Adrian EK, Dewitt AI, Garza JR. Double or bifid zygomaticus major muscle: anatomy, incidence, and clinical correlation. *Clin Anat.* 1998;11(5):310-313.
7. Satiroglu F, Arun T, Fulya I. Comparative data on facial morphology and muscle thickness using ultrasonography. *Eur J Orthod.* 2005;27(6):562-567.
8. Furnas DW. The retaining ligaments of the cheek. *Plast Reconstr Surg.* 1989;83(1):11-16.
9. Nemoto Y, Sekino Y, Kaneko H. Facial nerve anatomy in eyelids and periorbit. *Jpn J Ophthalmol.* 2001;45(5):445-452.
10. Ferreira LM, Minami E, Pereira MD, Chohfi LM, Andrews Jde M. Anatomical study of the levator labii superioris muscle [in Portuguese]. *Rev Assoc Med Bras.* 1997;43(3):185-188.
11. D'Andrea E, Barbaix E. Anatomic research on the perioral muscles, function, maxillary, and mandibular bones. *Surg Radiol Anat.* 2006;28(3):261-266.
12. Mendelson BC. Extended sub-SMAS: dissection and cheek elevation. *Clin Plast Surg.* 1995;22(2):325-339.
13. Tremolada C, Fissette J, Candiani P. Anatomical basis for a safe and easier approach to composite rhytidectomy. *Aesthetic Plast Surg.* 1994;18(4):387-391.
14. Mowlavi A, Wilhelmi BJ. The extended SMAS facelift: identifying the lateral zygomaticus major muscle border using bony anatomic landmarks. *Ann Plast Surg.* 2004;52(4):353-357.
15. Macdonald MR, Spiegel JH, Raven RB, Kabaker SS, Maas CS. An anatomical approach to glabellar rhytids. *Arch Otolaryngol Head Neck Surg.* 1998;124(12):1315-1320.

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1. Iverson C, Christiansen S, Flanagan A, et al. *AMA Manual of Style*. 10th ed. New York, NY: Oxford University Press; 2007:229.