The Safe Face Lift with Bony Anatomic Landmarks to Elevate the SMAS

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The risk for facial nerve injury has been reported to be increased with the inclusion of superficial musculoaponeurotic system (SMAS) elevation as compared with a skin-only face lift. The facial nerve courses through the parotid gland. The SMAS is elevated superficial to the parotid gland. However, in elevating the SMAS anterior to the parotid gland, the facial nerve is at risk of injury where its branches emerge from the anterior edge of the parotid gland. The purpose of this study was to identify bony anatomic landmarks to predict the location of the anterior edge of the parotid gland to avoid injury to the facial nerve branches as they exit the parotid gland. The authors dissected 20 cadaver face halves to determine bony landmarks—the masseteric tuberosity and the inferior lateral orbital rim—to predict the location of the anterior parotid edge. Then they measured the anterior edge of the parotid gland in relation to the vector formed between these two bony landmarks. They identified and measured the most anterior portion of the parotid gland in relation to this vector. Then the most posterior aspect of the parotid gland in relation to this vector was measured. In the 20 dissections, the authors found the most anterior portion of the parotid gland to be 2.7 ± 1.0 mm anterior to the vector from the inferior lateral orbital rim to the masseteric tuberosity. The most posterior part of the anterior edge of the parotid gland in relation to this vector was found to be 1.0 ± 1.5 mm posterior to this vector. The parotid gland measured an average of 38.8 ± 3.5 mm in width from the tragus to the anterior parotid edge. In elevating the SMAS with a face lift, the facial nerve branches can be predicted to exit the anterior edge of the parotid gland, which can be located 38.8 mm anterior to the tragus and near the vector from the inferior lateral orbital wall to the masseteric tuberosity. (*Plast. Reconstr. Surg.* 111: 1723, 2003.)

The goal of a face lift is to rejuvenate and improve the appearance of the face. The rhytidectomy procedure should be performed to not only remove and tighten the excess and redundant skin but also to reverse the anatomic changes that occur with aging.[1] This surgical rejuvenation often cannot be achieved by mere excision of redundant skin but requires resuspension of the superficial musculoaponeurotic system (SMAS). Retensioning the SMAS transmits the multilinked fibrous support system of the facial soft tissues to provide a recontouring of the ptotic soft tissues.[2]

The risk for facial nerve injury has been reported to be increased with the inclusion of SMAS elevation as compared with a skin-only face lift. The facial nerve courses through the parotid gland. The SMAS is elevated superficial to the parotid gland. However, in elevating the SMAS anterior to the parotid gland, the facial nerve is at risk to injury where its branches emerge from the anterior edge of the parotid gland. The purpose of this study was to identify bony anatomic landmarks to predict the location of the anterior edge of the parotid gland to avoid injury to the facial nerve branches as they exit the parotid gland.

Materials and Methods

We dissected 20 cadaver face halves to determine bony landmarks—the masseteric tuberosity and the inferior lateral orbital rim—to predict the location of the anterior parotid edge (Fig. 1). Then we measured the anterior edge of the parotid gland in relation to the vector formed between these two bony landmarks. We identified and measured the most anterior portion of the parotid gland in relation to this vector. Next we measured the most posterior aspect of the parotid gland in relation to this vector. We also measured the anterior edge of the parotid gland from the tragus along the transverse vector of the zygomatic arch.

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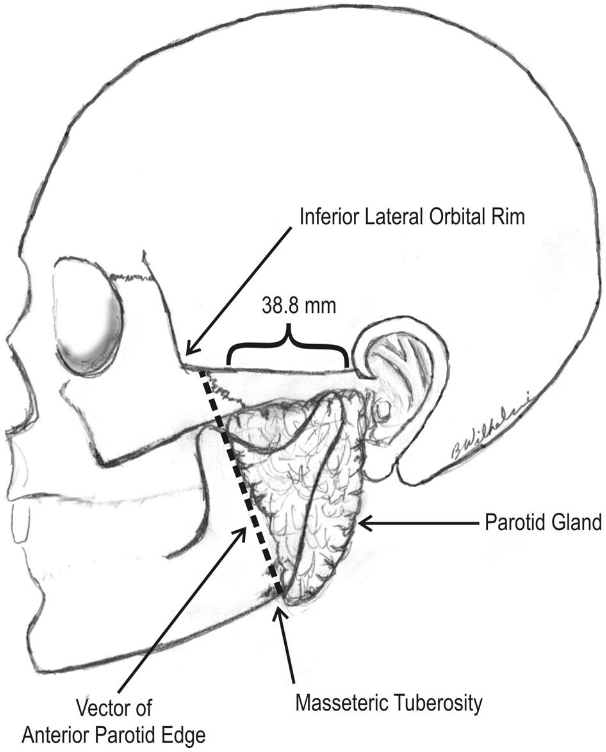

FIG. 1. This figure demonstrates the bony landmarks that can be used to predict the anterior edge of the parotid gland. The oblique vector of the anterior edge of the parotid gland extends from the inferior lateral aspect of the orbit (*large arrow*) to the masseteric tuberosity (*small arrow*). The anterior edge of the parotid gland averaged 38.8 mm from the tragus along the transverse vector of the zygomatic arch.

FIG. 2. This photograph shows the anterior edge of the parotid gland extending from the hemostat adjacent to the inferior lateral orbit superiorly to the hemostat at the masseteric tuberosity inferiorly. The anterior edge of the parotid gland along the oblique vector has been marked with a *dotted line* from the bony landmarks of the inferior lateral orbit to the masseteric tuberosity.

RESULTS

In the 20 dissections, we found the most anterior portion of the parotid gland to be 2.7 $\pm$ 1.0 mm anterior to the vector from the inferior lateral orbital rim to the masseteric tuberosity. We found the most posterior part of the anterior edge of the parotid gland in relation to this vector to be 1.0 $\pm$ 1.5 mm posterior to this vector. The parotid gland measured an average of 38.8 $\pm$ 3.5 mm in width from the tragus to the anterior parotid edge (Fig. 2).

DISCUSSION

The facial nerve originates in the pons between cranial nerves VI and VIII. The facial nerve leaves the calvaria, passing through the facial canal of the temporal bone to exit from the stylomastoid foramen. The main trunk of the facial nerve courses 0.5 cm to 1.5 cm before entering the posterior aspect of the parotid gland. The critical landmarks which can be used to identify the main trunk of the facial nerve include 1 cm below the conchal cartilaginous pointer and 6 to 8 mm below the tympanomastoid sulcus, where it crosses the styloid process and the anterior to the posterior belly of the digastric muscle.

The main trunk of the facial nerve enters the parotid gland, splitting it into lateral and deep lobes. The parotid gland is physiologically a unilobular structure without a separate ductile system for each lobe. However, passing through the substance of the parotid gland, the facial nerve does separate the parotid into two portions, known as the lateral and deep lobes. With dissection superficial to the parotid gland, the facial nerve is protected by this glandular tissue of the lateral lobe of the parotid. Within the parotid gland, the facial nerve splits into many branches. Several facial nerve branching patterns have been identified. In fact, Davis et al.[3] described six different patterns after 350 facial half dissections. These branches of the facial nerve are susceptible to injury once they emerge from the anterior edge of the parotid gland. Several anatomic studies of the facial nerve have been performed to minimize the risk to injury of the structure with facial procedures. In the course of the facial nerve branches to their target muscles, there are three danger zones where these branches are susceptible to injury: the frontal branches, the marginal mandibular branches, and the midfacial branches.

The frontal branch of the facial nerve has been described to have a consistent course from 0.5 cm below the tragus to 1.5 cm above the lateral brow.[4] Furthermore, Ishikawa[5] described the safe zone for prevention of injury to the frontal branch of the facial nerve to be 4 cm above and 7 cm posterior to the lateral canthus. The frontal branch has also been found to have multiple rami in another cadaver study by Gosain et al.[6] However, the most important anatomic study was performed by Stuzin et al.,[7] who defined the location of the frontal branch in three-dimensional planes located on the underside of the temporoparietal fascia above the zygomatic arch. Therefore, when dissecting in the area cephalic to the zygomatic arch, it is critical to be subcutaneous to the superficial temporal fascia or deep to the superficial layer of the deep temporal fascia to avoid injuring the frontal branch.[8]

The marginal mandibular branch was extensively studied by Dingman and Grabb[8] in 100 cadaver dissections. They found that, posterior to the facial artery, the marginal nerve passed above the inferior border of the mandible in 81 percent of their dissections. Anterior to the facial artery, 100 percent of marginal branches were located superior to the inferior mandibular edge.[8]

Posteriorly, the buccal branches of the facial nerve are well protected by the SMAS and parotid gland. However, anterior to the parotid gland, the SMAS becomes more fragile and the buccal branches of the facial nerve are more susceptible to injury. The buccal branches lie immediately under the SMAS and deep facial fascia as they course over the masseter muscle. Knowing the location of the anterior edge of the parotid gland, where the midfacial nerve branches exit, can minimize the risk for injury of these nerve branches. The sub-SMAS fat pad can also aid in identifying the location of the anterior edge of the parotid gland.[1] Knowing the location of the anterior edge of the parotid gland and exiting midfacial nerve branches can facilitate safe release of the parotidocutaneous ligaments. If the SMAS is not freed just anterior to the parotid, it does not move freely because of the resistance of the parotidocutaneous ligaments.[9]

The SMAS is a strictly superficial anatomical structure of the face derived from the primitive platysma, and it does not possess any bony insertions. It is composed of a composite fibrofatty layer of collagen and elastic fibers interspersed with fat cells and some muscle. There is no parotid aponeurosis; the parotid is surrounded by a capsule.[10] The SMAS is located superficial to the parotid capsule. It is continuous with the posterior portion of the frontalis muscle and temporoparietal fascia in the upper face and the platysma muscle inferiorly in the neck and the risorius and triangularis in the cheek.[11,12]

Biomechanical studies have demonstrated an advantage to the addition of SMAS tightening to the face lift procedure. Har-Shai[13,14] studied the viscoelastic properties of the SMAS and found that it had less slackening effect compared with preauricular skin, which would explain the lasting effect with the use of the SMAS. Several different SMAS tightening procedures have been described.[1,2,12,15–19] There has certainly been considerable controversy over which tightening procedure provides the best aesthetic outcome. A prospective study compared the lateral, standard, and extended SMAS and composite rhytidectomies and found no discernible difference between these procedures.[20] Recently, another technique was described by Stuzin et al.[21] to enhance facial contour, which involves folding the cephalic edge of the SMAS over Vicryl mesh. This technique can correct the changes in facial shape that occur with aging and the descent of facial fat. Although most plastic surgeons agree that treatment of the SMAS should be a component of the face lift, there is still controversy over which is the best technique.

Regardless of what technique of SMAS dissection is performed with the facelift procedure, it is important to avoid injury to the facial nerve branches. Therefore, in performing the SMAS procedure, knowledge of these landmarks, the masseteric tuberosity and inferior later orbital rim can provide the surgeon with the safe zone of SMAS dissection, where the facial nerve is protected within the parotid gland and at minimal risk for injury.

Conclusions

In elevating the SMAS with a face lift, the facial nerve branches can be predicted to exit the anterior edge of the parotid gland, which can be located 38.8 mm anterior to the tragus along the transverse axis of the zygomatic arch. Moreover, the anterior edge of the parotid gland can be predicted to be near the oblique vector from the inferior lateral orbital wall to the masseteric tuberosity.

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REFERENCES

1. Stuzin, J. M., Baker, T. J., Gordon, H. L., and Baker, T. M. Extended SMAS dissection as an approach to midface rejuvenation. *Clin. Plast. Surg.* 22: 295, 1995.
2. Mendelson, B. C. Extended sub-SMAS: Dissection and cheek elevation. *Clin. Plast. Surg.* 22: 325, 1995.
3. Davis, R. A., Anson, B. J., Budinger, J. M., and Kurth, L. E. Surgical anatomy of the facial nerve and parotid gland based upon a study of 350 cervico-facial halves. *Surg. Gynecol. Obstet.* 102: 385, 1956.
4. Pitanguy, I., and Ramos, A. S. The frontal branch of the facial nerve: The importance of its variation in face lifting. *Plast. Reconstr. Surg.* 38: 352, 1966.
5. Ishikawa, Y. An anatomical study on the distribution of the temporal branch of the facial nerve. *J. Craniomaxillofac. Surg.* 18: 287, 1990.
6. Gosain, A. K., Sewall, S. R., and Yousif, N. J. The temporal branch of the facial nerve: How reliably can we predict its path? *Plast. Reconstr. Surg.* 99: 1224, 1997.
7. Stuzin, J. M., Wagstrom, L., Kawamoto, H. K., and Wolfe, S. A. Anatomy of the frontal branch of the facial nerve: The significance of the temporal fat pad. *Plast. Reconstr. Surg.* 83: 265, 1989.
8. Dingman, R. O., and Grabb, W. C. Surgical anatomy of the mandibular ramus of the facial nerve based on the dissection of 100 facial halves. *Plast. Reconstr. Surg.* 29: 266, 1962.
9. Stuzin, J. M., Baker, T. J., and Gordon, H. L. The relationship of the superficial and deep facial fascias: Relevance to rhytidectomy and aging. *Plast. Reconstr. Surg.* 89: 441, 1992.
10. Delmar, H. Anatomy of the superficial parts of the face and neck (in French). *Ann. Chir. Plast. Esthet.* 39: 527, 1994.
11. Mitz, V., and Peyronie, M. The superficial musculoaponeurotic system (SMAS) in the parotid and cheek area. *Plast. Reconstr. Surg.* 58: 80, 1976.
12. Jost, G., and Lamouche, G. SMAS in rhytidectomy. *Aesthetic Plast. Surg.* 6: 69, 1982.
13. Har-Shai, Y., Bodner, S. R., Egozy-Golan, D., et al. Mechanical properties and microstructure of the superficial musculoaponeurotic system. *Plast. Reconstr. Surg.* 98: 59, 1996.
14. Har-Shai, Y., Bodner, S. R., Egozy-Golan, D., et al. Viscoelastic properties of the superficial musculoaponeurotic system (SMAS): A microscopic and mechanical study. *Aesthetic Plast. Surg.* 21: 219, 1997.
15. Skoog, T. G. *Plastic Surgery: New Methods and Refinements.* Philadelphia: Saunders, 1974.
16. Owsley, J. Q., Jr. Platysma-fascial rhytidectomy. *Plast. Reconstr. Surg.* 60: 843, 1977.
17. Jost, G., and Levet, Y. Parotid fascia and face lifting: A critical evaluation of the SMAS concept. *Plast. Reconstr. Surg.* 74: 42, 1984.
18. Webster, R. C., Smith, R. C., Papsidero, M. J., Karolow, W. W., and Smith, K. F. Comparison of SMAS plication with SMAS imbrication in face lifting. *Laryngoscope* 92: 901, 1982.
19. Baker, D. Rhytidectomy with lateral SMASectomy. *Facial Plast. Surg.* 16: 209, 2000.
20. Ivy, E. J., Lorenc, Z. P., and Aston, S. J. Is there a difference? A prospective study comparing lateral and standard SMAS face lifts with extended SMAS and composite rhytidectomies. *Plast. Reconstr. Surg.* 98: 1135, 1996.
21. Stuzin, J. M., Baker, T. J., and Baker, T. M. Refinements in face lifting: Enhanced facial contour using Vicryl mesh incorporated into SMAS fixation. *Plast. Reconstr. Surg.* 105: 290, 2000.