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ORIGINAL ARTICLE FACIAL SURGERY

The Inclusion of Orbicularis Oculi Muscle in the SMAS Flap in Asian Facelift: Anatomical Consideration of Orbicularis Muscle and Zygomaticus Major Muscle

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Abstract

Background In the malar region, the SMAS flap can be thin and tear easily, making it difficult to securely fix it. And the surgical anatomy of the region may be unclear and confusing. The authors performed an anatomical study on the location of the lateral margin of the orbicularis oculi muscle (OOM) and the origin of the zygomaticus major muscle (ZMM) when using a high-SMAS facelift with finger-assisted spaces dissection technique, which included elevation of the SMAS flap with OOM.

Methods One hundred twenty-one Asian patients underwent this facelift procedure. Of those, the distances between the posterior margin of tragus and the lateral margin of the OOM and the center of the origin of the ZMM were measured in 20 patients.

Results The mean age of the initial 121 patients was 50.9 years. In all cases, improvement was seen in soft tissue sagging of the midface and lower face. There was no functional impairment of the OOM. In 20 patients of them, the lateral margin of the OOM and the center of the origin of the ZMM were located at mean distances of 50.6 (range 48–53 mm) and 61.0 mm (range 60–65 mm) from the posterior margin of the tragus.

Conclusions The SMAS flap with the OOM is sufficiently strong enough so that it can maintain the pulling force and also helps to securely fix it. The authors hope that these anatomical findings would be useful when performing it and aid in the understanding of the relationship between the muscles in the malar area.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Facelift · Orbicularis oculi muscle · Zygomaticus major muscle · Orbicularis branch · Asian · SMAS

Introduction

The demand for Asian facelifts is increasing due to the economic development and the increase in the aging population. Asian faces are generally wide and flat in shape, with skin and retaining ligaments that are generally thicker and tougher. So, achieving a good result in a facelift is a challenge [1–3]. Particularly, improvement of the midface is not only difficult, but anatomically complex. Techniques such as high-SMAS, extended-SMAS, and the FAME technique have been proposed to improve the midface and lower face [4–8]. However, anteriorly in a SMAS flap, the concept of anatomy and procedure vary with different surgeons, and especially the surgical anatomy of the orbicularis oculi muscle (OOM) in the malar region is not clear. The authors present their anatomical, technical, and clinical findings for a series of Asian patients undergoing facelifts with incorporated OOM.

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Materials and Methods

From April 2011 to March 2015, 121 consecutive Asian patients underwent a facelift procedure that incorporated a high-SMAS technique and finger-assisted facial spaces dissection [2]. The indication for surgery was typical sagging of the middle and lower face. Additional procedures performed as necessary to improve facial aging included fat grafting (108 patients), brow lift (23 patients), upper blepharoplasty (18 patients), lower blepharoplasty (56 patients), and submentoplasty with medial platysmarrhaphy and subplatysmal fat debulking (34 patients). The distances between the posterior margin of the tragus and the lateral margin of the orbicularis oculi muscle and to the center of the origin of the zygomaticus major muscle were measured in a subset of 20 patients (Figs. 1, 2).

Surgical Technique

After the patient was given general anesthesia or intravenous sedation, 1% lidocaine with 1:200,000 epinephrine was infiltrated along the incision. Tumescent solution consisting of 0.1% lidocaine with epinephrine (1:1,000,000) was infiltrated into both sides of the face, with approximately 120–150 mL administered per side. An incision was made along the temporal hairline, the tragal margin, and the occipital hairline, and a skin flap was elevated and dissected over the body of the zygoma. A transverse incision was made on the SMAS following the superior border of the zygomatic arch and continued obliquely (anteriorly) to prevent a dog-ear. A vertical incision was made 1 cm anterior to the preauricular skin incision and followed inferiorly and posteriorly up to the anterior border of the sternocleidomastoid. To avoid injury to the temporal nerve branches at the zygomatic arch, the dissection was carefully made with the SMAS flap placed

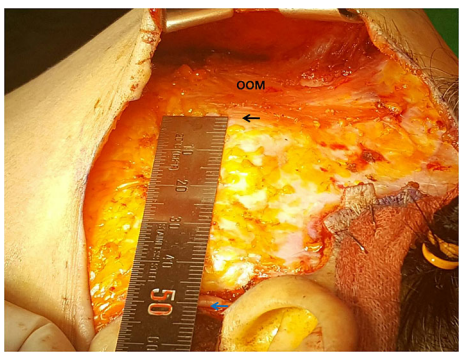

Fig. 1 After skin flap elevation, the orbicularis oculi muscle (OOM) was visualized. The distance between the lateral margin of the OOM (black arrow) and the posterior margin of tragus (blue arrow) was measured

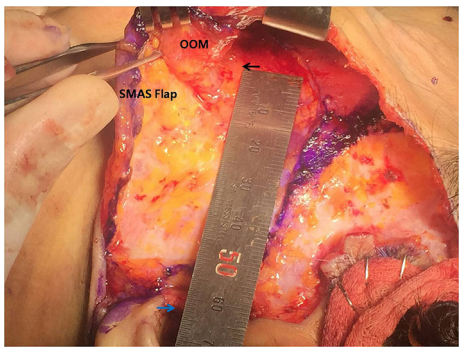

Fig. 2 The SMAS flap with the OOM was elevated. The distance between the center of the origin of the ZMM (black arrow) and the posterior margin of the tragus (blue arrow) was measured

under cephalad traction. Anterior and inferior to the SMAS, the orbicularis oculi and platysma were connected and included in the SMAS flap dissection. The main zygomatic and upper masseteric retaining ligaments were released carefully, without injury to the facial nerve branches (Fig. 3). Finger elevation of the malar fat pad was performed through the prezygomatic space between the orbicularis oculi and the zygomaticus (Fig. 4). In a similar fashion, finger dissection was performed to the mandibular ligament through the premasseter space, between the platysma and the masseteric fascia (Fig. 5). Release of the retaining ligaments was confirmed with a traction test, and the SMAS flap was redraped in the cheek. The SMAS flap

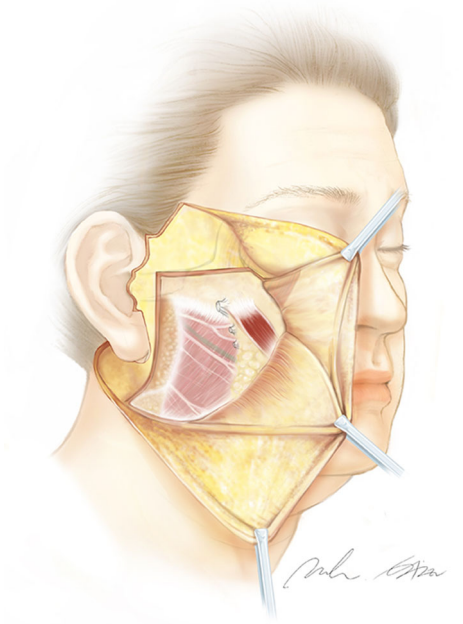

Fig. 3 The SMAS flap, including the orbicularis oculi and platysma, was elevated. Release of the zygomatic and upper masseteric retaining ligaments in the sub-SMAS plane was important to identify the branches of the facial nerve and the origin of the zygomaticus major [2]

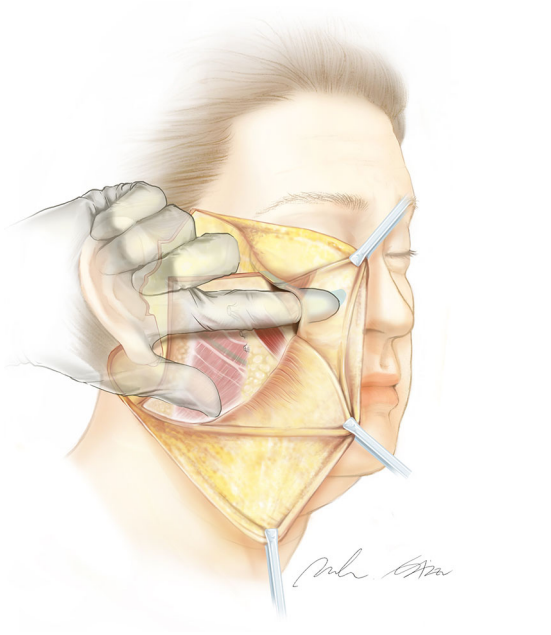

Fig. 4 Finger elevation of the malar fat pad was achieved through the prezygomatic space under the orbicularis oculi [2]

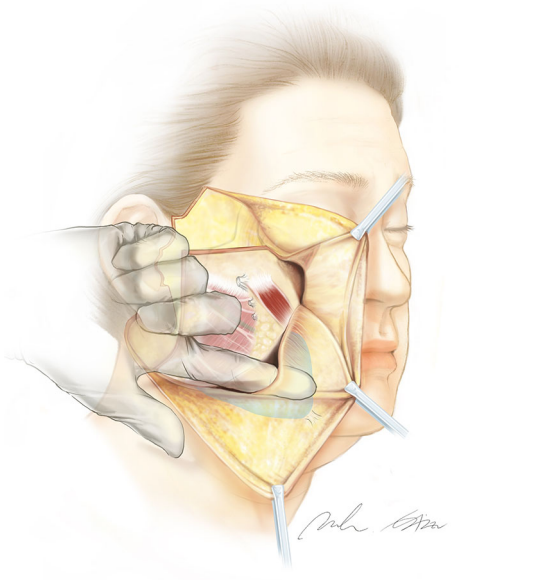

Fig. 5 Finger dissection under the platysma to the mandibular ligament was achieved through the premasseter space [2]

was pulled parallel to the vector of the long axis of the zygomaticus major and brought to the edge of the original SMAS incision. Redundant tissue was then excised. The preauricular SMAS flap was transposed postauricularly and fixed to the mastoid fascia. The cheek skin flap was redraped in a vector perpendicular to the nasolabial fold, and the postauricular skin flap was redraped parallel to the mandibular border. After redundant skin was excised, skin closure was performed with minimal to no tension. After closed suction and placement of Silastic drains (Dow Corning, Midland, MI), a gentle compression dressing was applied [2].

Results

Among the 121 Asian patients (111 women and 10 men), the mean age was 50.9 years (range 33–67 years). Patients received either general anesthesia (71 patients) or intravenous sedation with local anesthesia (50 patients). The mean postoperative follow-up was 38 months (range 11–63 months). In all cases, improvement in soft tissue sagging was seen in the midface and lower face (Figs. 6, 7). One patient experienced unilateral temporal nerve injury, 5 experienced hematoma, and 2 had wound dehiscence. There was no functional impairment of OOM. An anatomical study was conducted in a subset of 20 patients (18 females and 2 males). The mean patient age in this subset was 53.6 years (range 33–67 years). Measurements were taken from the right side of the face in 18 patients and from the left side of the face in 2 patients. The lateral margin of the orbicularis oculi muscle and the center of the origin of zygomaticus major muscle were located at mean distances of 50.6 (range 48–53 mm) and 61.0 mm (range 60–65 mm) from the posterior margin of tragus, respectively (Figs. 8, 9).

Discussion

As the knowledge of the facial anatomy expanded, a variety of facelift techniques have been proposed. Among them, the high-SMAS facelift, the extended-SMAS facelift, and the facelift with the FAME technique representatively demonstrate that the concept of facelift extends not only to the lower face, but also to the midface [4–8]. Even though the lower face and midface have the same goal of pulling the sagging tissue, their concepts and techniques are different. Particularly, the surgical anatomy is not clear in the malar region in relation to the OOM. So the anatomical concept and procedure for this area were closely examined.

Aston's FAME (finger-assisted malar elevation) technique attempts to dissect the malar fat pad with the fingers to improve the lower and midface in conjunction. The FAME technique involves elevating the lateral OOM and malar fat pads through the prezygomatic space, which overlies the body of the zygoma. The origins of the zygomatic muscles extend under the floor, and the roof is formed by the orbicularis oculi lined by the suborbicularis oculi fat [9]. He reported that since 2006 he has applied the extended-SMAS flap to the FAME composite deep-plane flap to increase the mobility of the malar soft tissue [8].

Fig. 6 A 48-year-old female who underwent a facelift with high-SMAS and finger-assisted facial spaces dissection technique. She also had lower blepharoplasty, liposuction of the submental area, and fat grafting of the nasolabial fold and cheek. Twenty-eight-month follow-up after surgery. Preoperative frontal (**a**), oblique (**c**), and lateral views (**e**). Postoperative frontal (**b**), oblique (**d**), and lateral views (**f**)

Fig. 7 A 64-year-old female who underwent a facelift with high-SMAS and finger-assisted facial spaces dissection technique. She also had fat grafting of the central forehead, upper medial malar area, and nasolabial fold. She had undergone face and neck lift by another surgeon 4 years ago. Twelve-month follow-up after surgery. Preoperative frontal (**a**), oblique (**c**), and lateral views (**e**). Postoperative frontal (**b**), oblique (**d**), and lateral views (**f**)

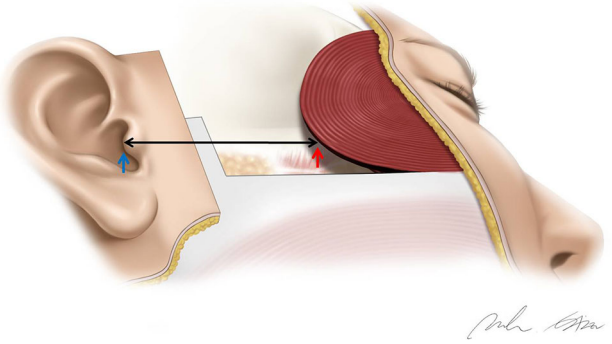

Fig. 8 The lateral margin of the OMM (red arrow) was located at a mean distance of 50.6 mm (range 48–53 mm) from the posterior margin of the tragus (blue arrow)

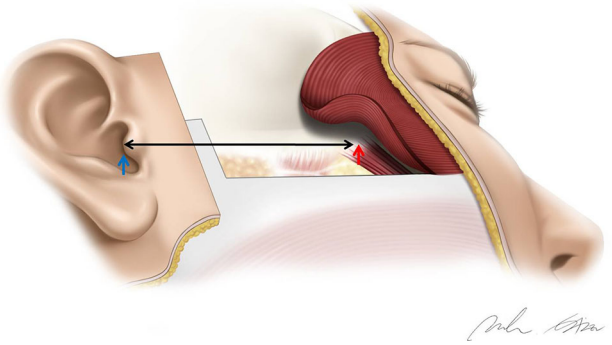

Fig. 9 The center of the origin of the ZMM (red arrow) was located at a mean distance of 61.0 mm (range 60–65 mm) from the posterior margin of the tragus (blue arrow)

Therefore, this method can be considered the SMAS flap with the elevated OOM flap. Mendelson reported that in his facelift technique, the SMAS layer was incorporated in OOM in the zygomatic part of the midcheek. Using the lateral border of the OOM as a landmark, the muscle is elevated and the separated OOM is connected with the SMAS on the same layer [6]. Thus, the OOM is incorporated in the SMAS flap in his method [6, 9]. Mitz and Peyronie reported that the SMAS invests and extends into the peripheral part of the orbicularis oculi muscle [10].

In Marten's high-SMAS technique, though not clearly described, the authors believe that the SMAS flap is elevated with the OOM. In his surgical photographs, the SMAS flap is elevated over the ZMM and appears to contain the OOM superficially. The tissue overlying the SMAS was called the malar fat pad, but is red in color and contains fibers running in a circular fashion, which is consistent with the OOM [5]. Additionally, because the OOM covers the origin of the ZMM, the OOM must be elevated to expose the ZMM. Thus, we believe that this technique also includes the OOM with SMAS flap elevation.

The main advantage of the inclusion of the OOM in the SMAS flaps is that it allows elevation of a good-quality flap. The purpose of a facelift is to improve the facial contour by pulling the descended tissue. The dissection, reposition, and fixation of tissue are all important processes, and it is difficult to expect good results even if one of them is neglected. To allow a firm fixation, it is very important to have a sufficiently strong and rigid flap that can hold the pulling force.

On the other hand, Stuzin et al. noted concerns with the thinness of the SMAS in the anterior midface and potential difficulties with fixation. He believed that the SMAS tends to become thinner and less substantial toward the front of the face. The SMAS flap was elevated along the superficial surface of the OOM in the malar region. The exclusion of the OOM may have contributed to a thin SMAS flap. To ensure stable fixation, he instead elevated a thinner skin flap, leaving more subcutaneous fat on the SMAS flap, and at times folded the flap to increase its thickness [7].

Because it is more difficult to improve the midface due to the unique facial characteristics of Asians, it is necessary to pay close attention to the fixation of tissues. There is a technique where the SMAS flap once elevated can be overlapped. In Caucasians, we believe it can be beneficial because it can supplement the deficient volume of the area. However, because it is important for Asians with large, and broad faces, to look smaller, volume often times has to be reduced in those areas. It is therefore necessary not to overlap the elevated SMAS flap. So, once the elevated SMAS is fixated, the redundant tissue is excised. So at the end, the elevated and lifted SMAS is fixed back to the SMAS edge, which we believe is stable. It is important to properly release the retaining ligaments in the sub-SMAS plane, so that the dissected SMAS flap can be pulled up without resistance and repositioned. If not fully released and elevated, the SMAS flap will likely tear or the fixation will loosen. Thus, proper release of the retaining ligaments of the sub-SMAS plane is essential to achieve a stable fixation of the SMAS flap onto the remaining SMAS edge. In addition, because the SMAS flap with the OOM has sufficient thickness and rigidity, it is possible to stabilize layer by layer in the malar region and positively impact midface lifting.

There are potential disadvantages to OOM dissection, with the concern being potential functional impairment of the muscle. The orbicularis branch to the OOM has a highly variable course [5, 11, 12]. Care should be taken not to damage the orbicularis branch in instances where it arises lateral to the ZMM. The orbicularis branches were often identified about 1–1.5 cm lateral to the origin of the zygomaticus major muscle. If the orbicularis branch more than moderate thickness is identified within the SMAS layer, tissue excision should be avoided (Fig. 10). Often,

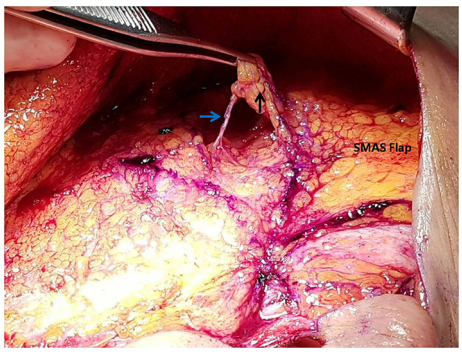

Fig. 10 The SMAS flap was fixed to the superior and posterior edge of the original SMAS incision. Redundant tissue was excised except for the remnant SMAS tissue (black arrow) innervated by orbicularis branches (blue arrow)

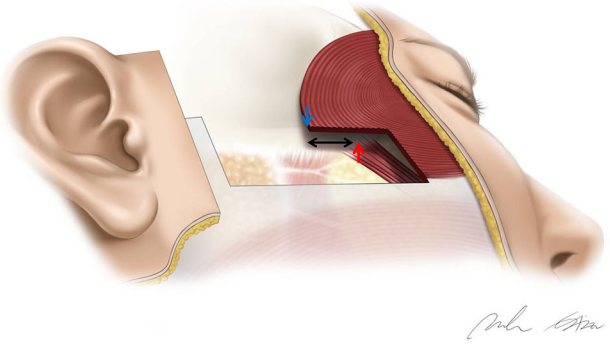

Fig. 11 The distance between the lateral margin of the OOM (blue arrow) and the center of the origin of the ZMM (red arrow) was about 10 mm. The OOM covered the ZMM and was wider

the orbicularis branch cannot be identified in elevation of the OOM with the SMAS flap. This can be due to the course variations or the fine arborization of the orbicularis branch within the ZMM. The plexiform nature of OOM innervation may be protective [13, 14]. Selective dissection limited to the peripheral portion of the lower lateral aspect of the OOM likely also limits the risk of nerve injury and muscle trauma. Thus, the authors have not experienced this complication, and there have been no reports of functional impairment of the OOM by other surgeons who have extensive experience performing OOM elevation.

Our series included 1 case of unilateral temporal nerve injury. The operating surgeon believes this occurred during the fixation of the SMAS flap. During efforts to achieve rigid fixation to the zygomatic arch, multiple attempts were made to grab the periosteum, which was a technical mistake. Thereafter, care was taken to avoid affixing the flap to the midportion of the zygomatic arch where the temporal nerve runs, and further injury to the temporal nerve was averted. On the upper border of the zygomatic arch, the parotid-temporal fascia protects the temporal branch of the facial nerve; therefore, the SMAS can be divided between the SMAS and parotid-temporal fascia without injuring the nerve [2, 15].

The surgical anatomy of the malar region and the relationship of the SMAS to the orbicularis oculi and the underlying zygomaticus major muscle can be particularly complex and unclear. Our work provides a closer anatomical study of this region in the context of facelift surgery in Asian patients. Our detailed anatomical study found that the lateral margin of the OOM and the center of the origin of ZMM were located at mean distances of 50.6 (range 48–53 mm) and 61.0 mm (range 60–65 mm) from the posterior margin of tragus, relatively. The distance between the lateral margin of the OOM and the center of the origin of the ZMM was about 10 mm. The OOM covered the ZMM and extended farther laterally (Fig. 11). To visualize the ZMM, the OOM must be elevated. Elevation of the OOM and identification of the ZMM as a landmark led to consistent outcomes in our series of this facelift technique in Asian patients.

Conclusion

The thicker retaining ligaments and skin of the Asian face, as well as its broad, flat midface contour, often require more aggressive methods to achieve such outcomes. However, it is often the case that the SMAS in the malar region is thinly elevated and poorly fixed. The authors were able to overcome this challenge by including the OOM with their SMAS elevation to provide a high-quality flap for appropriate and durable tissue resuspension. The relationship between the muscles in the malar area was unclear, but our careful anatomical study confirmed that the OOM extended laterally beyond the origin of the ZMM by approximately 10 mm and that the OOM must be elevated to identify the deeper ZMM. The authors hope that these anatomical findings would be useful when performing it and aid in understanding the relationship between the muscles in the malar area. Because of the small number of patients evaluated in this study, the limited follow-up period, and a general lack of reported data in the Asian literature, further studies are needed to evaluate and refine our approach in this patient population.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest to disclose.

Ethical Standard The authors have conformed to the Declaration of Helsinki.

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