Individualized Considerations Regarding Sub-Superficial Musculoaponeurotic System Facelift Techniques

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Based on a thorough understanding of facial structure around the superficial musculoaponeurotic system (SMAS), some types of sub-SMAS techniques have emerged to allow more harmonious rejuvenation procedures in the lower face and midface. These techniques are the Hamra composite facelift, the Stuzin extended SMAS technique, the Barton high SMAS technique, and the Ramirez subperiosteal facelift, each of which involves a specific dissection plane and is informed by distinct rationales with reasonable support. Each patient presents a unique facial structure and undergoes an individual rate of aging. The facial structures of East Asian faces, in particular, differ from those of Western faces. While emphasizing that the theory of structural mid-cheek anatomy is an essential part of facial rejuvenation, we would like to discuss the advantages and disadvantages of various sub-SMAS facelift techniques and to propose the most suitable techniques for a variety of individual faces.

Keywords Facial muscle, Rhytidoplasty, Superficial musculoaponeurotic system

INTRODUCTION

Since the introduction of the technique reported by Skoog [1] and the study of Mitz and Peyronie [2] regarding the superficial musculoaponeurotic system (SMAS), the concept of facial rejuvenation has entered a new phase, going beyond the conventional subcutaneous facelift technique. However, Mitz and Peyronie [2] focused on the SMAS layer lateral to the zygomaticus major muscle—in other words, the lower face. In response to the development of the SMAS technique for facial rejuvenation, the emphasis in the approach to the lower face including the lateral neck has changed accordingly, recently being referred to as cervicofacial rhytidectomy.

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Cervicofacial rhytidectomy may offer successful lower cheek and jawline rejuvenation, but shows less success for rejuvenation of the malar region and of the infraorbital area medial to the zygomaticus major muscle. When using this technique, due to poorly balanced descent of the untouched malar area, a well-rejuvenated lower face will appear dissonant with the malar region over the years. Remnants of the dissonance may sometimes be noticeable, and this is called a lateral sweep deformity. In an effort to overcome the problem posed by lateral sweep deformities, facial rejuvenation techniques have evolved to focus on various sub-SMAS facelift methods. The evolution of facial rejuvenation surgery reflects recent innovations in the detailed understanding of the retaining ligament, as described by Furnas [3] and Stuzin et al. [4], and has been further improved by a sophisticated theoretical approach to the mid-face and periorbital region [5-9].

The most commonly adopted techniques may be the composite facelift described by Hamra [5,6], the extended SMAS technique developed by Stuzin et al. [4], the high SMAS technique proposed by Barton [8], and the subperiosteal facelift developed by Ramirez et al. [7]. Since each technique has specific advantages and disadvantages, we believe that proper indications must be identified for

each technique in order to achieve optimal outcomes. We would like to provide an analysis of each of these 4 techniques from an objective perspective based on thorough understanding of the facial anatomy. This analysis is intended to be of further assistance in the proper selection of facial rejuvenation techniques with regard to the variety of individual faces, allowing for optimal results to be obtained using each facial procedure.

Facial rejuvenation techniques

Based on the priorities of the inventors of each surgical technique, the Hamra composite facelift, the Stuzin extended SMAS technique, the Barton high SMAS technique, and the Ramirez subperiosteal facelift are defined by their own particular dissection planes and distinct rationales for which reasonable support exists. While emphasizing the necessity of a theoretical approach that posits structural mid-cheek anatomy as an essential part of facial rejuvenation, we would like to discuss the advantages and disadvantages of various sub-SMAS facelift techniques.

The Hamra composite facelift

Hamra is one of the pioneers of facial rejuvenation. After the introduction of the deep plane rhytidectomy in 1990, followed by attempts at many modified versions, Hamra [6] reported the composite facelift technique the following year, emphasizing the malar region and periorbital rejuvenation. In 1998, Hamra [5] aimed to further improve his composite facelift technique through the introduction of zygorbicular dissection as the best option for an ideal midfacial dissection plane [10]. Hamra was the first to adopt periorbital rejuvenation as an extended approach to facial rejuvenation, and he presented remarkable outcomes compared to those of previous conventional rhytidectomy procedures. It has been generally appreciated that his publications contain thorough explanations of his approach, accompanied by schematic figures that illustrate his technique at a glance. Repeated modifications of his technique and improvements in periorbital rejuvenation using zygorbicular dissection have led to outstanding results.

However, the zygorbicular dissection method carries with it the problem of a statistically significant period of postoperative periorbital edema, the cause of which is suspected to be the blockage of periorbital venous drainage. According to current understanding, the periorbital vein runs laterally to medially across the orbit, taking a path within the suborbicularis oculi fat (SOOF). As it reaches the mid-portion of the inferior orbital area, the periorbital vein anastomoses with the angular vein that runs alongside the medial band of the orbicularis oculi muscle (OOc) (Fig. 1).

Hamra described a zygorbicular dissection to make a surgical separation between the OOc and the SOOF as the dissection proceeds inferiorly. This specific suborbicularis dissection may carry a higher risk of trauma to the anastomosis area of the periorbital vein. Thus, we can presume that the long duration of the postoperative

Fig. 1. Anastomosis of the periorbital vein with angular vein in the inferior orbital area (left; cadaveric dissection of the infraorbital region). The periorbital vein runs laterally to medially across the orbit, taking a path within the suborbicularis oculi fat (SOOF). As it reaches the mid-portion of the inferior orbital area, the periorbital vein anastomoses with the angular vein that runs alongside the medial band of the orbicularis oculi muscle. *The periorbital vein is indicated with a diamond, the angular vein with a star, the zygomaticus minor muscle with a spade, the zygomaticus major muscle with a clover, and the SOOF with a heart.*

periorbital edema is correlated with the submuscular plane of the zygorbicular dissection. Another potential risk when performing zygorbicular dissection is injury to the branches of the facial nerves innervating the OOc and zygomaticus minor muscle. Anatomic evidence for this is provided by Ramirez and Santamarina's study [11] showing that the innervation path of the facial motor nerve branch extends to the OOc (Fig. 2). For this reason, it is interesting to observe that a number of Hamra's patients who were thought to have experienced full neurotization were described to have presented at long-term follow-up with noticeable lower lid hypotonicity. In approximately 60% of cases, the medial band of the orbicularis oculi shared an interconnection with the zygomaticus minor muscle and ran deeper than the OOc fibers at the level of the mid-portion of the infraorbital area (Fig. 3) [12,13]. Thus, surgeons who perform zygorbicular dissection proceeding beyond the OOc and zygomaticus minor muscle to reach the zygomaticus major muscle will confront the complexity of the anatomy of the mid-lateral infraorbital area.

The Barton high SMAS facelift

Barton's technique for facial rejuvenation, which has come to be known as the high SMAS technique, is to perform limited subcuta-

Fig. 2. Passage of the facial nerve (zygomatic branch) to the orbicularis oculi muscle (OOc) via the zygomaticus major and minor muscles. The zygomatic branch runs below both the zygomaticus major muscle (where the muscle is divided) and the zygomaticus minor muscle (where the muscle is also divided) to innervate the medial part of the orbicularis oculi muscle. The zygomatic branch of the facial nerve is indicated with a triangle, the zygomaticus major muscle with a clover, the zygomaticus minor muscle with a spade, and the OOc with a heart.

Fig. 3. The medial band of the orbicularis oculi shares an interconnection with the zygomaticus minor muscle and runs deeper than the orbicularis oculi muscle (OOc) fibers at the level of the mid-portion of infraorbital area. The medial band of the OOc is indicated with a blue triangle, the fusion with the zygomaticus minor muscle (spade) is indicated with a red triangle, the OOc is indicated with a heart, and the zygomaticus major muscle is indicated with a spade.

Fig. 4. Passage of the facial nerve innervating the lateral orbicularis muscle, from the parotid gland to the orbicularis muscle. Pink-colored marking points out the lateral canthus. (A) After exiting the parotid gland, facial nerves go through the deep fascia (the superficial layer of deep temporal fascia). (B) Twigs of the facial nerve branches innervate the lateral part of the orbicularis oculi muscle via the superficial layer of the deep temporal fascia. The superficial layer of the deep temporal fascia is indicated with a heart, the twigs of the facial nerve with a triangle, and the suborbicularis oculi fat with a star. OOc, orbicularis oculi muscle; SMAS, superficial musculoaponeurotic system.

neous dissection and to reposition the elevated SMAS flap to the upper border level of the zygomatic arch [8,14,15]. Ideally, skin attached as an integral part of the SMAS flap presents the advantage

of a more secure flap with shorter operative time.

With this technique, effective rejuvenation can be achieved in patients with a similar degree and direction of sagging in both the

Fig. 5. (A, B) The zygomaticocutaneous ligament holds the lower margin of the suborbicularis oculi fat (SOOF). The orbicularis oculi muscle is indicated with a heart, the zygomaticocutaneous ligament with a triangle, the zygomaticus minor muscle with a spade, the zygomaticus major muscle with a clover, and the SOOF with a star.

skin and SMAS tissue. In the high SMAS technique, the malar area is approached by including the OOC as a continuation of the SMAS flap [16], or by accessing the prezygomatic space by dissecting the plane underneath the SOOF [17]. An obvious issue arises at the lateral malar area. Strands of facial nerve branches innervating the lateral part of the OOC are in danger of injury during this procedure. Even though arguments can be made for a deeper sub-SOOF plane dissection, regardless of the dissection plane, denervation is inevitable when the lateral border of the OOC is manipulated (Fig. 4). If a dissection of the sub-muscular plane is attempted, passing the zygomaticus major and minor muscle medially, the branches of the facial nerve that innervate the medial portion of the OOC can be compromised (Fig. 2). Deeper sub-SOOF plane dissection, on the other hand, requires technical skill to fully release the zygomaticocutaneous ligament that holds down the lower margin of the SOOF (Fig. 5) [17]. Even when the rigid zygomaticocutaneous ligament is released and it is possible to reposition the flap, without adequate vertical upward vector fixation at the orbital rim, the SOOF, which functions as a main composer of the midface, will eventually sag. Moreover, brachycephalic East Asian facial morphology offers a very limited surgical view when approaching the deep fat layer medially at the mid-cheek area.

The Stuzin extended SMAS facelift

The hallmark of the Stuzin et al. [4] extended SMAS facelift is an independent upward vertical advancement and fixation of the SMAS flap together with a horizontal, relatively wide skin flap redraping. For cases with different vectors and degrees of aging change in the

SMAS and skin, the ability to adjust each vector as appropriate allows more control in facial rejuvenation. When elevating the SMAS flap, the dissection plane is superficial to the fibers of the mimetic muscles, distant from the facial nerve branches that lie deep to these muscles. This technique provides the advantage of a good surgical view with a small bleeding focus accompanied by very little postoperative edema [18].

When the SOOF and deep fat are not elevated, common adjunct procedures can be performed with confidence, such as fat grafting into the uncompromised deep fat layer. However, the surgeon should always keep in mind that undermining the wide skin raises concerns regarding the viability of the skin flap. To perform wider and more viable skin undermining, a longer surgery time is required and care must be taken to ensure thorough bleeding control of the subcutaneous pocket.

In this technique, the malar SMAS flap involves the superficial fat (inferior orbital fat) that overlies the OOC surface. Some cases of low-weight patients with a very thin malar SMAS have been described. In this circumstance, an inexperienced surgeon may confront difficulty in malar dissection. Especially in patients with thin skin, a further troubling risk is the introduction of contour irregularities by small indurations in the malar area.

In assessing facial patterns in accordance with anthropometry, the term scaphocephalic is commonly used to describe Western facial morphology, while the term brachycephalic applies to that of East Asian patients.

In patients with brachycephalic facial morphology, greater bizygomatic distance and a prominent malar area should be taken into

account when designing the malar SMAS flap. When dissection is initiated near the malar center, as for Western patients with a weak malar area, there is a high risk of increase in bizygomatic distance, which is contradictory to the typical desire of East Asian patients to have a smaller and softer-looking face. Thus, when performing the extended SMAS technique, it is necessary to adjust the malar SMAS flap carefully, according to the prominence of the development of the zygomatic bone.

The Ramirez subperiosteal facelift

Ramirez et al. [7] introduced a subperiosteal endoscopic midface enhancement technique, in which the temporal tunnel is used for access from the forehead elevation. As widely accepted, the subperiosteal lift elevates vital tissue en bloc while keeping its structure intact, offering the advantage of minimal tension to the SMAS and skin, and also keeping it free from nerve injury. Distinct from other sub-SMAS techniques, this technique pursues a harmonious relationship between ptosis of the lateral brow and midface rejuvenation. In addition, it is greatly effective in shortening the apparent vertical lid length of the lower eyelid by creating better periorbital rejuvenation. When more superficial structure completes the shape of the facial contour, the periosteum, the deepest structure of the soft tissue envelope, might transmit unsatisfying lifting pull for surface rejuvenation, especially for cases with excessive sagging skin and subcutaneous fat descent. Moreover, this technique is insufficient for reducing the facial dimension. Using interconnected subperiosteal pockets to approach from the temple to midface, the vector of pull will replace the zygomaticus muscle origin to a more superolateral direction, widening the bizygomatic distance. Thus, careful assessment is required to obtain good aesthetic results in East Asian faces with prominent malar regions using this technique. Theoretically, the subperiosteal facelift is acknowledged as a technique that does not cause nerve injury. In fact, facial nerve branches exist in very close relation to the periosteal attachment site of the zygomatic ligament. The facial nerve also runs adjacent to the area where the upper masseteric ligament is attached to the masseter muscle fascia. It is quite important to obtain full release through cautious dissection of these structures without damage to the facial nerve branches (Fig. 6). Another notable problem is the difficulty in meticulous hemostatic control of the small artery that runs within these main ligaments. The suspension method through the temporal pocket seems technically challenging for beginners.

Preferred indications for each technique

Each patient presents with a distinctive facial structure and ages differently. Moreover, the facial structure of East Asians differs from that of Western faces. Each sub-SMAS facelift technique has both its advantages and disadvantages, based on which we are now able to propose the most suitable technique for specific facial structures.

Fig. 6. Facial nerve branches exist in very close relation to the periosteal attachment site of the zygomatic ligament. Facial nerves also run adjacent to the area where the upper masseteric ligament is attached to the masseter muscle fascia. The zygomatic ligament is indicated with a triangle, and the masseteric ligament with a star.

The composite facelift technique

The composite facelift is excellent for periorbital rejuvenation, which is indicated for patients with an obvious tear trough deformity, long vertical lid length, and with aging changes in the lower face. This technique carries the risk of ectropion due to the downward recurrence of the extensively mobilized malar SMAS flap. It is positively indicated for patients with retruded eyeballs and maxilla of a positive vector. When the patient is exophthalmic and has a hypoplastic maxilla, it is best to avoid this technique.

The high SMAS technique

With its characteristics of limited skin dissection and repositioning of the SMAS and skin in one unit, the high SMAS technique offers the best result for patients with a similar degree and direction of sagging in both the skin and the SMAS tissue. When approaching the mid-cheek area crossing the zygomaticus major muscle medially, this technique offers a relatively limited surgical view. The way to obtain smoother transit in this area is to apply this technique to patients with more scaphocephalic facial structures and with less prominent zygomatic bones and maxillae. To offer the patient a more aesthetically pleasing mid-cheek rejuvenation with the high SMAS technique, a concomitant SOOF lift can be useful.

The extended SMAS technique

The extended SMAS technique was originally invented for mid-cheek rejuvenation and it is indicated for patients with notable malar and anterior malar fat descent or for patients with different vectors and degrees of aging changes in the SMAS and skin. In addition, as the flap is elevated superficial to the orbicularis oculi mus-

cle, patients suffering from lower lid ectropion as a result of ptotic anterior lamella can benefit from this technique. Unfortunately, the extended SMAS technique can widen the bimalar distance, and for an inexperienced surgeon, it is best to be aware of this issue and to avoid patients with a wide bimalar distance.

The subperiosteal facelift

The subperiosteal facelift technique pursues a harmonious relationship between ptosis of the lateral brow and midface rejuvenation, offering the best results for patients with brow ptosis and mid-cheek sagging. It is most clearly indicated for patients with a similar degree of descent of both the deep and superficial tissue; in theory, it should be able to control superficial contours through deep periosteal manipulation.

CONCLUSION

Through a thorough understanding of the facial structure around the SMAS and retaining ligaments, facial rejuvenation has evolved to incorporate various types of sub-SMAS techniques that are able to provide harmony in lower face and midface rejuvenations. Each technique has opened new possibilities for achieving high-quality results. Subsequent generations of facial surgeons have offered detailed anatomical evidence that has revealed certain shortcomings of each technique, which seems to be an inevitable feature of pioneering work. It is our duty to be aware of the advantages and disadvantages of each technique and to remedy any shortcomings. By mastering each technique, we are able to offer proper surgical choice according to the variety of faces and to meet individual aesthetic needs.

PATIENT CONSENT

Patients provided written consent for the use of their images.

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