

A Comparison Between Two Methods of Face-Lift Surgery in Nine Cadavers: SMAS (Superficial Musculo-Aponeurotic System) Versus MACS (Minimal Access Cranial Suspension)

Shabahang Mohammadi¹ · Aslan Ahmadi¹ · Mohammad Mahdi Salem¹ · Mahdi Safdarian¹ · Shahriar Ilkhani¹

Received: 2 May 2015 / Accepted: 24 July 2015

© Springer Science+Business Media New York and International Society of Aesthetic Plastic Surgery 2015

Abstract

Background This study aimed to compare the average amounts of facial skin and muscle lifting in two different face-lift methods, superficial musculo-aponeurotic system (SMAS) plication and minimal access cranial suspension (MACS), to evaluate the effectiveness of each method in facial excursion.

Methods Thirty-six face-lift surgeries were performed on nine cadavers between October and December 2010. Both SMAS and MACS surgeries were done on each side of the cadaver faces. The average amounts of skin and muscle lifting up and out in three defined anatomical landmarks were compared between the two methods, SMAS plication and MACS lift procedure.

Results Nine fresh cadavers with the mean age of 53 ± 6.7 years entered the study. Seven (77.8 %) were males and two (22.2 %) were females. The average amounts of lifting of the anatomical landmarks up and out were significantly greater in the SMAS plication method compared to the MACS lift procedure (P values <0.05), whereas facial symmetry was not significantly different between the two methods.

Conclusion The overall amounts of facial skin and muscle lifting by the SMAS plication method were greater than the MACS lift procedure. However, it does not justify ignoring the benefits of the MACS lift procedure in terms of less invasiveness and quicker recovery.

No Level Evidence This journal requires that authors assign a level of evidence to each submission to which

Evidence-Based Medicine rankings are applicable. 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 SMAS · MACS Lift · Face-Lift · Cadaver

Introduction

The goal of all face-lift procedures is to provide a natural, long-lasting, and rejuvenated cosmetic result without any permanent adverse effects, such as facial nerve damage [1]. Facial esthetic surgery commonly aims to repair deepening of the nasolabial folds and midfacial soft tissue descent. There have been many attempts to address these age-related changes both surgically and nonsurgically [2]. A comprehensive understanding of the facial anatomy and different procedures is necessary to perform an effective face-lift surgery [3].

Mitz and Peyronie first described the deep layer of the superficial facial fascia and named it the “superficial musculo-aponeurotic system” (SMAS) [4]. Many surgeons believed that the results of a SMAS face-lift were long-lasting and outstanding for the neck but not as good for the melolabial fold region [1].

While different face-lift techniques have been described, there is still a trend towards limited operative time and less invasive procedures.

The minimal access cranial suspension (MACS) lift, from Tonnard and Verpaele, is a short scar rhytidectomy with vertical purse string suture suspension of the facial tissue [5]. This procedure reduces recovery time and morbidity, and results are as stable as most traditional face-lift techniques [6].

✉ Mohammad Mahdi Salem
Mmsalem2@gmail.com

¹ ENT and Head & Neck Research Center, Rasoul Akram Hospital, Iran University of Medical Sciences, Tehran, Iran

There are some studies comparing the results of different methods of face-lift surgeries [1, 7–9]. This study was designed to compare the average amounts of facial lifting between the SMAS plication and MACS lift procedures in nine cadavers.

Materials and Methods

Ethical Approval

This study was approved by the local ethics committee of Forensic Medicine Organization of the Islamic Republic of Iran, according to the certification from Iran University of Medical Sciences Research Council. All the Information of the cadavers will remain confidential.

Design

Between October and December 2010, thirty-six surgeries were done on nine fresh cadavers; two surgeries on each half of the cadaver faces. First, we did MACS on one side of the face and then SMAS plication on the same side. The same process was done for the other side of face that means finally we performed eighteen SMAS plications and eighteen MACS lifts.

Facial topography was done with the cadavers in the lying position. Three anatomical landmarks were defined on the cadaver faces: The junction of the Marionette lines with the border of the lower jaw, the crossing between the lateral edge of the lip with the midline of the pupil, and the angle of the lower jaw (Fig. 1). These landmarks were

intentionally defined to place all components of each part, especially the nervous system, inside the incision areas. To evaluate the symmetry of the face, both methods of SMAS plication and MACS lift were performed on each side of the cadaver face to determine the average amount of skin lifting on each side.

The results of lifting three defined anatomical landmarks on two sides of the face were compared separately between the two methods; for example, the average amount of lifting at the junction of the Marionette lines and the border of the lower jaw with SMAS in the right side was compared with the same result on the left side and also with the result of the MACS lift.

Esthetic results were evaluated by two independent and board-certified ENT surgeons in the operating room.

Method of Surgeries

First, we did a minimal incision from the root of the helix to the inferior part of the lobule in the vertical direction then we dissected the supra-SMAS plane to the anterior border of the parotid gland and inferiorly in the neck until we saw the platysma. After that, we extended the superior part of the incision transverse in the temporal fossa about two centimeters in the hairline and exposed the periosteum of the temporal bone (Fig. 2). Then we performed three classic types of sutures in the MACS lift on each side of the face and fixed them to the temporal periosteum in an upward direction (Fig. 3). After evaluation of three landmarks in the face, we opened each suture and then again, we performed SMAS plication. We extended the incision in the neck as modified for SMAS plication. Then we

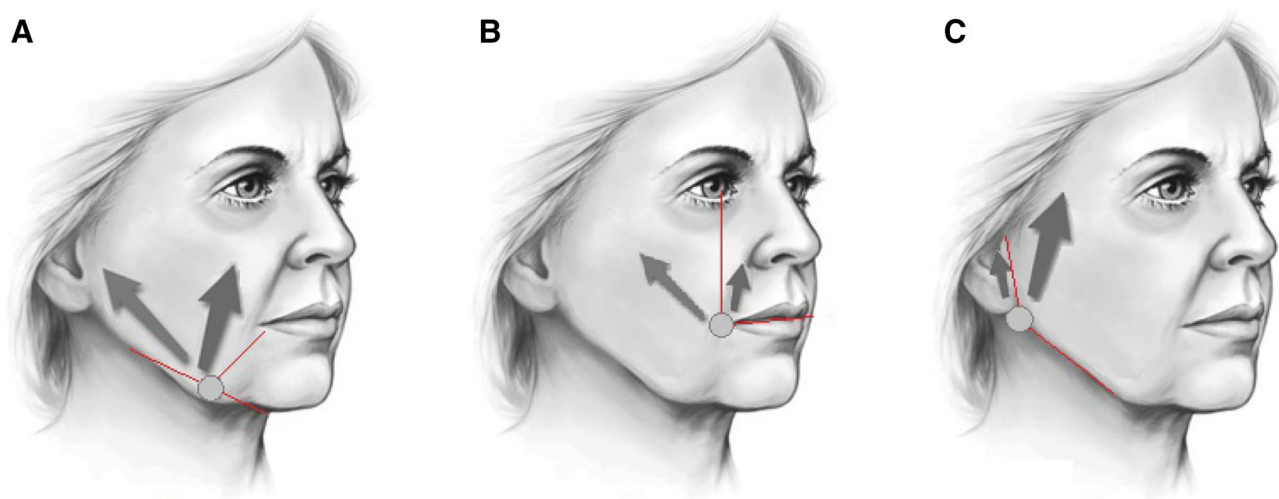


Fig. 1 Three defined anatomical landmarks: **a** The junction of the Marionette lines with the border of the lower jaw. **b** The crossing between the lateral edge of the lip with the midline of the pupil. **c** The angle of the lower jaw

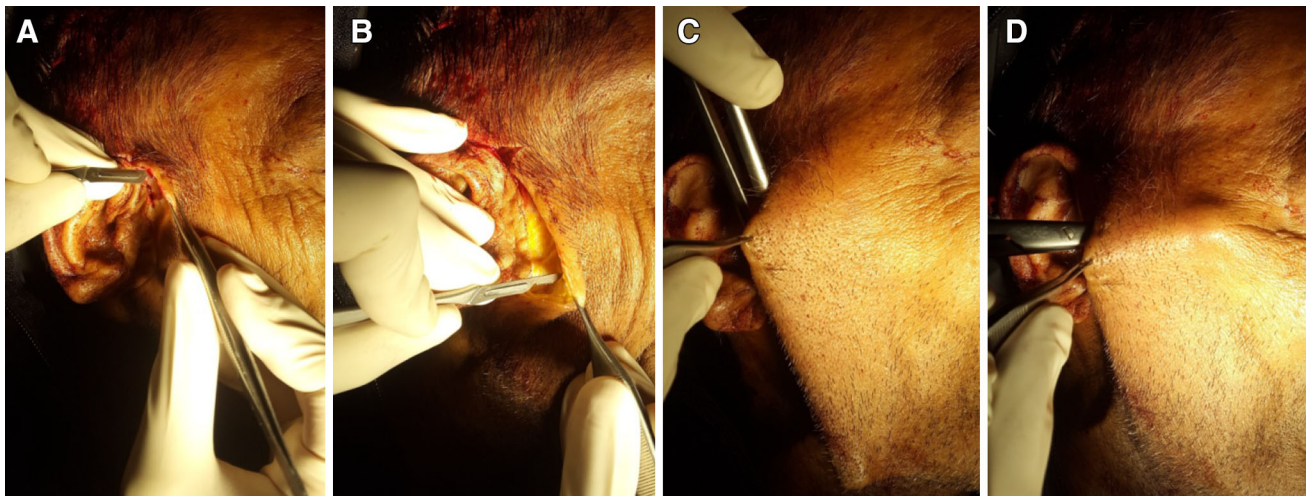


Fig. 2 A minimal incision was done from the root of the helix to the inferior part of the lobule in a vertical direction (a, b). The supra-SMAS plane was dissected to the anterior border of the parotid gland and inferiorly in the neck (c, d)

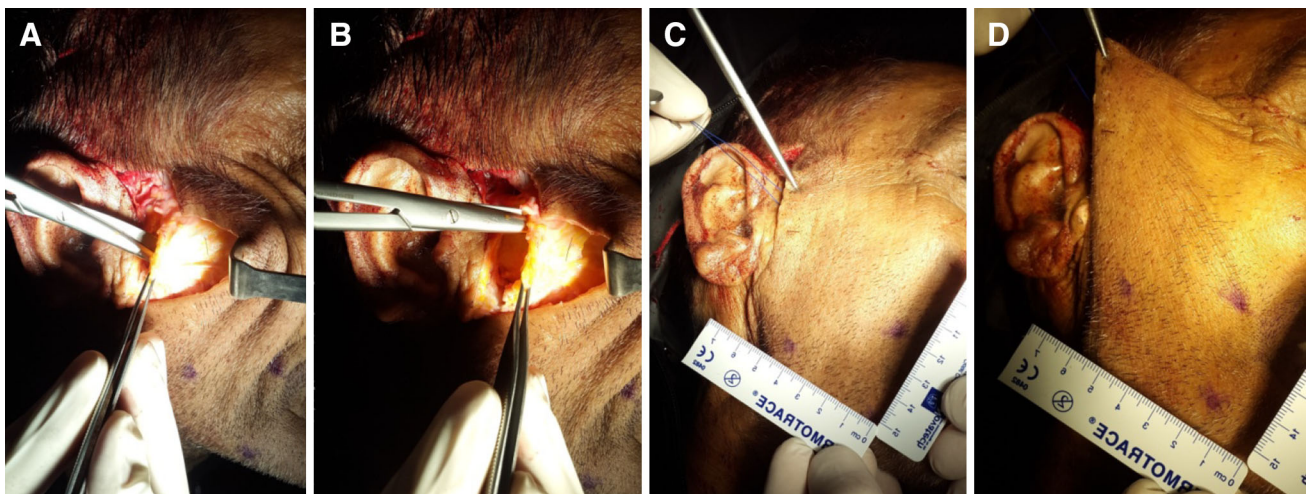


Fig. 3 Three classic types of sutures in a MACS lift (a, b). Then we fixed them to the temporal periosteum in an upward direction and evaluated the three landmarks lifting (c, d)

dissected the SMAS completely and plicated it with absorbable suture in lateral and upward directions (Fig. 4).

Statistical Methods

The data analysis was done using SPSS software version 18 (SPSS Inc, Chicago, Illinois, USA). Because the sample size was small, a one-sample Kolmogorov–Smirnov (KS) test was used to find normal distribution of the data and Leven’s test was done for the evaluation of the equality of variances. We used a paired sample *T* test for parametric variables and Wilcoxon signed-rank test for non-parametric variables. *P* values less than 0.05 were considered as significant.

Results

Nine fresh cadavers entered the study with the mean age of 53.11 ± 6.71 (between 45 and 65 years). Seven (77.8 %) were males and two (22.2 %) were females.

The average age was 54 ± 6.90 for men and 50 ± 7.07 for women. The body mass indices of cadavers were in the range of 25–35.

The average amounts of skin and muscle lifting up and out in centimeter at any defined landmark were compared between the SMAS plication and MACS lift methods (Table 1 & 2). As shown in Table 1, the average amounts of lifting of the three defined anatomical landmarks up and out were significantly greater in SMAS plication compared with the



Fig. 4 SMAS plication was performed on the same face-half extending the incision as modified for SMAS plication (a, b). The SMAS was dissected completely and plicated with absorbable suture in lateral and upward directions (c, d)

Table 1 Average amounts of skin lifting up and out in the vertical direction in SMAS plication and MACS lift methods for each landmark

Anatomical landmarks	Mean \pm SD (cm)		<i>P</i> value
	SMAS	MACS	
A			
Up			
Left	2.05 \pm 0.15	1.8 \pm 0.12	<0.001
Right	2.06 \pm 0.14	1.9 \pm 0.15	<0.001
Out			
Left	1.17 \pm 0.18	1 \pm 0.15	<0.001
Right	1.21 \pm 0.15	1.07 \pm 0.16	<0.001
B			
Up			
Left	2.38 \pm 0.18	2.1 \pm 0.13	<0.001
Right	2.34 \pm 0.30	2.14 \pm 0.27	<0.001
Out			
Left	1.26 \pm 0.17	1.1 \pm 0.18	<0.001
Right	1.32 \pm 0.43	1.13 \pm 0.38	<0.001
C			
Up			
Left	0.56 \pm 0.11	0.4 \pm 0.09	0.008
Right	0.54 \pm 0.10	0.46 \pm 0.1	0.001
Out			
Left	1.14 \pm 0.15	0.9 \pm 0.15	<0.001
Right	1.1 \pm 0.17	0.9 \pm 0.18	<0.001

MACS lift procedure (*P* values < 0.05). Table 2 shows that facial symmetry in each of the two methods was not significantly different between the two sides of the face. In other words, both SMAS and MACS procedures provided a parallel symmetry for each one of the three defined landmarks.

Table 2 Comparison between the average amounts of skin lifting up and out in the vertical direction in each half of the face with SMAS plication and MACS lift procedures

Method	Anatomical landmarks	Mean \pm SD (cm)		<i>P</i> value
		Left	Right	
SMAS				
A				
Up		2.06 \pm 0.14	2.05 \pm 0.15	0.7
Out		1.21 \pm 0.15	1.17 \pm 0.18	0.3
B				
Up		2.34 \pm 0.3	2.36 \pm 0.18	0.6
Out		1.32 \pm 0.4	1.26 \pm 0.17	0.6
C				
Up		0.54 \pm 0.1	0.56 \pm 0.11	0.3
Out		1.1 \pm 0.17	1.14 \pm 0.15	0.4
MACS				
A				
Up		1.9 \pm 0.15	1.8 \pm 0.12	0.6
Out		1.07 \pm 0.16	1 \pm 0.15	0.08
B				
Up		2.14 \pm 0.27	2.13 \pm 0.13	0.8
Out		1.13 \pm 0.38	1.1 \pm 0.18	0.6
C				
Up		0.4 \pm 0.1	0.4 \pm 0.09	0.16
Out		0.9 \pm 0.18	0.9 \pm 0.15	0.29

A: The junction of Marionette lines and the border of the lower jaw

B: The crossing between the lateral edge of the lip and the midline of the pupil

C: The angle of the lower jaw

Discussion and Conclusion

The common goal of all face-lift procedures is to provide a long-lasting, natural, balanced, rejuvenated esthetic result with few complications and minimal downtime [2]. *The*

understanding of facial anatomy and its changes through aging has led to the development of progressively less invasive techniques, such as the MACS lift, to respond to these core concerns [10].

The MACS lift technique, a short scar face-lift, is a simple procedure for mediofacial aging. This procedure involves no lateral tension, and may be performed with the patient under local anesthesia in 2–2.5 h [11]. This technique, in the simple or extended variation, delivers a reproducible and natural rejuvenation of the face and neck with minimal morbidity and a quicker recovery [12]. It is effective, providing a high level of patient satisfaction due to esthetic results, combined with rapid recovery and return to normal activities [13]. The MACS lift has been described to correct sagging and laxity of the lower and middle third of the face. It does not, however, fully address the neck or the lateral periorbital area frequently needing rejuvenation in most patients. Another shortcoming of the minimal access cranial suspension lift technique is visible scarring anterior to the temporal hairline that usually occurs despite the suggested surgical maneuvers consisting of zigzag beveled incisions [14].

SMAS plication, on the other hand, represents a growth that seeks to balance procedural invasiveness with recovery time and esthetic outcomes [15]. SMAS plication, malar fat pad repositioning, and correct traction of facial tissues also showed satisfactory results. This technique is less aggressive than undermining of the SMAS and deep-plane techniques [16].

The platysma muscle, submuscular aponeurotic system, and galea are the continuous superficial cervical fascia encompassing the majority of face, and this superficial soft tissue envelope is poorly anchored to the face [17]. Modern face-lift techniques have benefited from shorter incisions, more limited dissection of the SMAS and platysma and limited skin elevation to shorten postoperative recovery time and reduce surgical risks for patients [2].

The understanding of facial anatomy and its changes through aging has led to the development of several different face-lift techniques. Facial aging is mainly due to gravity's long-term effects on the superficial soft tissue envelope, with more subtle effects on the deeper structural compartments [17]. Gassner et al. studied 50 cadaveric heads bilaterally, to delineate the anatomic architecture of the melolabial fold with surrounding structures. In contrast to previous reports, the SMAS was not found to form an investing layer in the midface. The findings of this study may augment our understanding of the complex anatomy of the midface and melolabial fold [18]. *The extreme interest in developing new surgical approaches for rhytidectomy* has led to a more natural and youthful restoration of the face by together lifting forehead, midface, and lower face. This produces a more harmonious balance of the upper and lower portions of

the face than was possible before the introduction of face-lifting techniques [19].

There are a few studies in the literature, comparing results between different methods [18]. Adamson and his colleagues compared SMAS plication and deep-plane face-lift (DPFL) methods to determine if there is any observable difference in the midface of the patients. They defined five areas on the face and neck including the malar eminence, melolabial fold, jowls, cervicomental angle, and anterior neck banding and reported a significantly better improvement in both the midface and the neck of patients who underwent DPFL in comparison to SMAS plication [7].

In contrast, the comparative study by Becker et al. reported higher scores in terms of esthetic results for SMAS plication compared with DPFL. However, DPFL scored slightly higher in patients older than 70 years [1].

Prado et al., however, compared the outcomes of lateral SMASectomy and MACS lift in eighty-two patients retrospectively and reported no significant differences in cosmetic results between the two techniques at 1-month and 2-year postoperative follow-up [9].

Our study was designed to evaluate the average amounts of face lifting between two different methods: SMAS plication and MACS lift. However, the excursion of skin through the face-lift procedure is not the only criterion for validation of the technique. On the other hand, working with cadavers may not be so common in face-lift studies, but performing four surgeries on one face is almost only possible in a cadaver model; however, we tried our best to perform surgeries on fresh and even warm cadavers. The cadaver model also has another important limiting factor, in the aspect of long-term follow-up.

We put some representative photographs, containing the procedures performed on cadavers. However, the face is a complex 3-dimensional structure with different contours even within an anatomic subunit, and assessment of results by a 2-dimensional photograph must be crude and inaccurate [20].

As a conclusion, we can say that the overall amounts of facial skin movement and manipulation by invasive SMAS plication were greater than that by the MACS lift procedure in our study. However, it does not justify ignoring the benefits of MACS lift in terms of less invasiveness and rapid recovery [13]. The keys to consistent results are the surgeon's judgment and ability to individualize a treatment plan according to the patient's needs. To obtain natural-appearing results, the surgeon must consider the morphological characteristics of the aging face.

Acknowledgments The authors wish to thank the editorial board and reviewers of Aesthetic plastic surgery journal for their support and feedback. This study was the otolaryngology residency thesis of Aslan Ahmadi M.D. and was approved and financially supported by

the ENT and Head & Neck Research Center of Rasoul Akram Hospital, Iran University of Medical Sciences, Tehran, Iran.

Compliance with Ethical Standards

Conflict of interest The authors have no other conflict of interest; financial or otherwise with any organization.

References

1. Becker FF, Bassichis BA (2004) Deep-plane face-lift vs superficial musculoaponeurotic system plication face-lift: a comparative study. *Arch Facial Plast Surg* 6(1):8–13
2. Jacono AA, Parikh SS (2011) The minimal access deep plane extended vertical facelift. *Aesthet Surg J* 31(8):874–890
3. Miller AJ, Graham HD 3rd (1997) Comparison of conventional and deep plane facelift. *J La State Med Soc* 149(11):406–411
4. Mitz V, Peyronie M (1976) The superficial musculo-aponeurotic system (SMAS) in the parotid and cheek area. *Plast Reconstr Surg* 58(1):80–88
5. Verpaele A, Tonnard P, Gaia S, Guerao FP, Pirayesh A (2007) The third suture in MACS-lifting: making midface-lifting simple and safe. *J Plast Reconstr Aesthet Surg* 60(12):1287–1295
6. Tonnard P, Verpaele A (2007) The MACS-lift short scar rhytidectomy. *Aesthet Surg J* 27(2):188–198
7. Adamson PA, Dahiya R, Litner J (2007) Midface effects of the deep-plane vs the superficial musculoaponeurotic system plication face-lift. *Arch Facial Plast Surg* 9(1):9–11
8. Jacono AA, Stong BC (2010) Anatomic comparison of the deep-plane face-lift and the transtemporal midface-lift. *Arch Facial Plast Surg* 12(5):339–341
9. Prado A, Andrades P, Danilla S, Castillo P, Leniz P (2006) A clinical retrospective study comparing two short-scar face lifts: minimal access cranial suspension versus lateral SMASectomy. *Plast Reconstr Surg* 117(5):1413–1425 **discussion 26–7**
10. Centurion P, Romero C, Olivencia C, Garcia RG, Pardo PK (2014) Short-scar facelift without temporal flap: a 10-year experience. *Aesthetic Plast Surg* 38(4):670–677 **Epub 2014/06/08**
11. Kestemont P (2009) Description and critical analysis of the “Tonnard and Verpaele’s” technique for malar suspension. *Ann Chir Plast Esthet* 54(5):421–424
12. Verpaele A, Tonnard P (2008) Lower third of the face: indications and limitations of the minimal access cranial suspension lift. *Clin Plast Surg* 35(4):645–659, vii
13. Mast BA (2014) Advantages and limitations of the MACS lift for facial rejuvenation. *Ann Plast Surg* 72(6):S139–S143
14. Atiyeh BS, Dibo S, Papazian N, Zgheib E (2015) Overcoming limitations of short scar minimal access cranial suspension facelift for enhanced rejuvenation. *J Craniofac Surg* 26(3):800–806
15. Berry MG, Davies D (2010) Platysma-SMAS plication facelift. *J Plast Reconstr Aesthet Surg* 63(5):793–800
16. Pitanguy I, Machado BH (2012) Facial rejuvenation surgery: a retrospective study of 8788 cases. *Aesthet Surg J* 32(4):393–412
17. Gordon N, Adam S (2014) Deep plane facelifting for facial rejuvenation. *Facial Plast Surg* 30(4):394–404
18. Gassner HG, Rafii A, Young A, Murakami C, Moe KS, Larrabee WF Jr (2008) Surgical anatomy of the face: implications for modern face-lift techniques. *Arch Facial Plast Surg* 10(1):9–19
19. Baker SR (2009) Deep plane rhytidectomy and variations. *Facial Plast Surg Clin North Am.* 17(4):557–573, vi
20. Hudson DA (2010) An analysis of unsolved problems of face-lift procedures. *Ann Plast Surg* 65(2):266–269