OPEN

PRS GLOBAL OPEN

ORIGINAL ARTICLE
Cosmetic

The Rationale of Coronal Approach to Malar/Zygoma Reduction

Jae-Yoon Seol, MD, PhD*
Kenneth K. Kim, MD, FACS†‡§

Background: Malar/zygoma reduction is an effective procedure to change a broader, flatter facial appearance to an oval facial shape. Of the intraoral and coronal approaches, the intraoral is the more commonly used technique than the coronal, due to the perception that complications with the coronal approach are significant, and intraoral results are satisfactory. We compared the postoperative effects of both approaches.

Methods: From 1994 to 1999, we included the 150 intraoral cases that were followed up for 3 years postoperatively. From 2000 to 2018, we changed our technique to the coronal approach and included the 575 cases that were followed up for 3 years postoperatively. We compared the results of our prior intraoral approach with the more recent coronal approach.

Results: All cases of the intraoral approach resulted in smaller-sized faces horizontally; however, 90 patients (60%) still had resulting flat-shaped faces due to acute angle formation in the resultant zygoma. There were 141 cases (94%) of partial malunion and 138 cases (92%) of midface ptosis. Among the 575 coronal approaches, 518 cases (90%) resulted in an oval facial shape without acute angled zygoma. There were 161 cases (28%) of visible incision scars, 466 cases (81%) of temporary alopecia, 12 cases (2%) of hematoma, and 29 cases (5%) of temporary frontal facial nerve injury.

Conclusions: The intraoral approach led to flat and acute zygomas. The majority of patients experienced midface soft tissue ptosis. In contrast, the coronal approach led to an oval facial shape. The most notable complications of the coronal approach were visible scars and temporary alopecia. *(Plast Reconstr Surg Glob Open 2023; 11:e5304; doi: 10.1097/GOX.0000000000005304; Published online 26 October 2023.)*

INTRODUCTION

Overall facial dimension and proportion are important in facial beauty. Facial bone shape and size are the foundation on which soft tissue sits and, together, help determine the overall facial appearance.[1] Since the introduction of facial bone surgery, there has been a continuous increase in the number of bone contouring surgery cases being performed in East Asia for cosmetic purposes. This is because East Asians in general tend to have wider zygomas and mandibles compared with other races[2] (Fig. 1). Although the zygoma and mandible both add to the facial shape, the laterally flaring and prominent zygoma contributes significantly in determining whether the facial shape is oval, round, or quadrangular.

Intraoral zygomatic reduction has been popular due to no visible scars. However, the intraoral approach to zygomatic reduction has three limitations. One is inadequate exposure for a medial zygoma osteotomy. The second limitation is an inability to perform a mechanically more advantageous high bony fixation at the lateral orbital rim. The third limitation is an inability to perform an adequate midface lift to prevent postoperative soft tissue ptosis.

For the intraoral approach to zygoma reduction, our technique was not different from the standard intraoral

*From *Seoljaeyoon Plastic Surgery, Seoul, South Korea; †Division of Plastic and Reconstructive Surgery, David Geffen School of Medicine at University of California, Los Angeles, Los Angeles, Calif.; ‡Kenneth K. Kim MD, Inc., Dream Medical Group, Los Angeles, Calif.; and §Department of Plastic and Reconstructive Surgery, Seoul National University College of Medicine, Seoul, South Korea*

Received for publication July 24, 2023; accepted August 16, 2023.

DOI: 10.1097/GOX.0000000000005304

Disclosure statements are at the end of this article, following the correspondence information.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

method, as described in prior publications.[1–3] For the intraoral approach, we will elaborate on the mechanics of the healing process and how it affects the facial aesthetics over time. For the coronal approach, we will describe our method of dissection, osteotomy, and fixation. In addition, we will review the effects of the coronal approach, as it relates to a more favorable osteotomy, secure bony fixation, and midface soft tissue support. Lastly, we will review the complications of our coronal approach cases.

METHOD

In all intraoral and coronal patients, cephalometric and submental vertex radiographs were taken. In some patients, three-dimensional computed tomography (CT) scans were also obtained for additional imaging guidance. All procedures were performed under general anesthesia through an orotracheal tube. Patients with wide bizygomatic distance and without significant medical conditions were included in the study. Patients with history of facial trauma or congenital deformities were excluded from the study.

Bicoronal Dissection

A bicoronal incision was performed by first braiding and tying the hair. A 15-blade was used to cut the scalp. The vessels in the scalp were carefully cauterized, and the dissection was performed to the level underneath the galea but above the periosteum. The dissection proceeded caudally to the superior orbital neurovasculatures. The superior orbital and trochlear neurovascular bundles were preserved. As the dissection approached the lateral orbital rim, the dissection was made in a subperiosteal plane down to the lower border of the zygoma. At this lower region of the zygoma, a superficial dissection of about 1–1.5 cm was also performed caudally to include the midface subcutaneous layer—thus, performing a dual plane.

Along the lateral incision, the dissection was made under the temporoparietal and innominate fascia (loose areolar layer) but above the temporalis muscle fascia. As the dissection approached the upper region of the zygomatic arch, the dissection was changed to the subperiosteal plane to expose the zygomatic arch and to avoid injuring the temporal branch of the facial nerve.

Osteotomies

The first of the two osteotomies started with the zygomatic arch. The osteotomy was at the area where the arch began to make an outward bowing or just anterior to the zygomatic tubercle. The osteotomy was angled in an oblique fashion by beveling the blade in an inward direction toward the midline. This ensured minimal step-off deformity after the reduction of the zygomatic arch.

Takeaways

Question: Intraoral malar/zygoma reduction produces unfavorable results such as flat facial shape, partial malunion, and midface ptosis.

Findings: The coronal approach resulted in a more oval and aesthetically pleasing facial shape due to favorable osteotomy and midface soft tissue support. It also produced a more biomechanically stable cheekbone due to high bone fixation.

Meaning: The coronal approach to zygoma/cheekbone reduction is a safe and effective method to narrow the cheekbones for an oval facial shape.

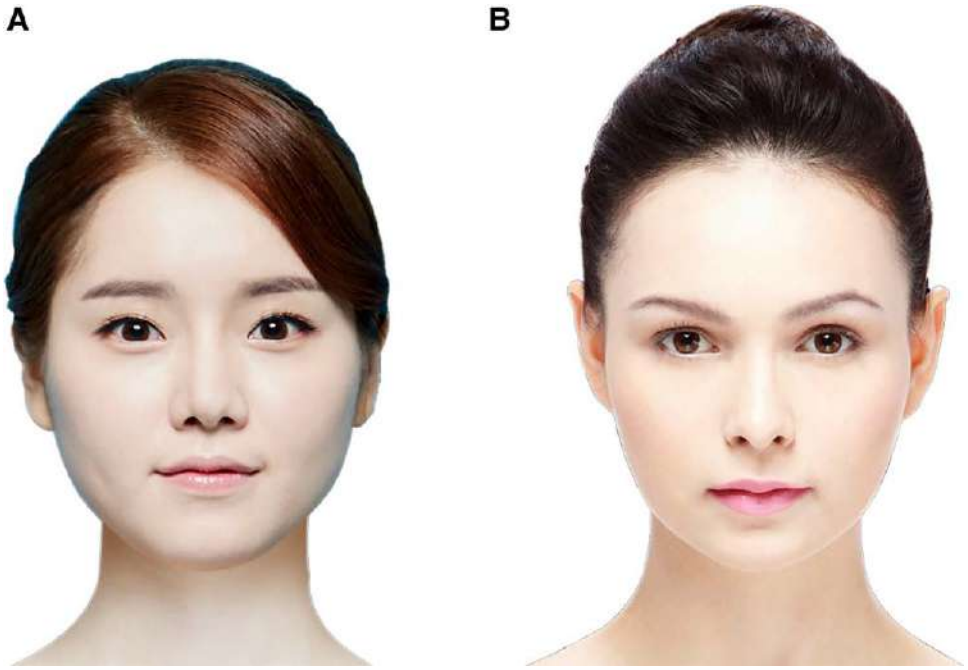

Fig. 1. Different facial shapes. East Asians in general tend to have wider zygomas and mandibles (as shown in A) than other races (as shown in B).

The second osteotomy was at the zygoma. The soft tissue retractor was placed at the bottom of the zygoma to protect the soft tissue. The reciprocating saw was placed medially and high along the lateral orbital rim. The medially placed osteotomy ensured that two-thirds of the lateral orbital rim was cut with the zygoma body osteotomy, leaving one-third of the orbital rim medially as a stable immobile region. The upper orbital osteotomy began at the level of the frontozygomatic suture line and continued caudally to the zygomaticomaxillary suture line.

Aesthetically Favorable Reduction of Zygoma

The cut zygomatic segment was repositioned in three directions/three-dimensionally: inward, medial, and superior. [**See Video 1 (online),** which displays how the cut zygomatic segment was repositioned in three directions/three-dimensionally: inward, medial, and superior.] The medial end of the cut zygomatic arch was first displaced inward. Then, the zygomatic body was positioned medial and superior. The inward and medial displacement narrowed the arch and the zygoma. The superior/cephalad movement of the zygomatic body allowed a more favorable and aesthetically pleasing high zygomatic position. In cases where moderate to significant displacement was needed, a small amount of the inner zygomatic body was excised to create space for the zygoma to be repositioned in an inward and upward direction. Once the cut segment of the zygoma was properly repositioned, two drill holes were made on each cut side of the orbital rim. Other drill holes were made on the cut ends of the zygomatic arch. The metal wires were then passed through the holes and secured tightly to hold the reduced body segments. The step-off deformity at the orbital rim and zygomatic body were burred down to create a smooth surface. [**See Video 2 (online),** which displays how the step-off deformity at the orbital rim and zygomatic body were burred down to create a smooth surface.] The orbital rim was further secured with metal miniplates. [**See Video 3 (online),** which displays how the orbital rim was further secured with metal miniplates.]

Midface Soft Tissue Suspension

The soft tissue, including the zygomatic major and minor muscles at the zygomatic body, was advanced to the upper zygomatic periosteum with 2-0 absorbable sutures (Vicryl) in a horizontal mattress fashion. [**See Video 4 (online),** which displays the soft tissue, including zygomatic major and minor muscles at the zygomatic body, was advanced to the upper zygomatic periosteum with 2-0 absorbable sutures (Vicryl) in a horizontal mattress fashion.] This was to ensure that midface soft tissue ptosis did not occur from the initial dissection and zygoma reduction. The other soft areas along the lateral zygoma and the zygomatic arch were also advanced to the upper intact periosteum for secure suspension of the masseter muscle and the overlying soft tissues.

RESULTS

From 1994 to 1999, among the patients who underwent intraoral zygomatic reduction, we included the 150 cases that were followed up for 3 years postoperatively. There were 35 men and 115 women. The ages ranged from 18 to 58, with an average age of 31. Among the intraoral approach patients, 90 cases (60%) resulted in a square and flat-shaped face due to acute angles in the resultant zygoma. There were 141 cases (94%) of partial malunion and 138 cases (92%) of midface ptosis. (**See table, Supplemental Digital Content 1,** which displays the results of intraoral zygomatic reduction cases. **http://links.lww.com/PRSGO/C787**.) We then converted our technique to the coronal approach. From 2000 to 2018, among the patients who underwent coronal zygomatic reduction, we included the 575 cases that were followed up for 3 years postoperatively. There were 75 men and 500 women. The ages ranged from 18 to 62, with an average age of 35. With the coronal approach, 518 cases (90%) resulted in an oval facial shape. In our coronal series, there were 29 cases (5%) of neuropraxia, which resolved within 3–6 months. There were no permanent facial nerve injury. In addition, there were 466 cases (81%) of temporary alopecia, and 161 patients (28%) experienced visible scalp scars. There were no cases of malunion and midfacial ptosis. There were 12 cases (2%) of hematoma, and no cases of infection (**See table, Supplemental Digital Content 2,** which displays the results of coronal zygomatic reduction cases. **http://links.lww.com/PRSGO/C788**.)

DISCUSSION

The malar/zygoma reduction was initially described via the intraoral approach in 1983 by Onizuka.[4,5] In 1991, Baek described a coronal approach to reduce the zygoma.[6] Until now, various intraoral approaches have been described, and the intraoral approach has gained much popularity.[3,7–13] The main reasons for preference toward the intraoral approach have been the lack of visible scars, avoidance of alopecia, and decreased chances of facial nerve injury. For these reasons, we also started performing zygomatic reduction via an intraoral approach. However, we noticed negative mechanical and aesthetic effects that resulted from limited surgical exposure that comes from the intraoral approach. These effects were unfavorable osteotomy, inadequate or unstable bone fixation, and midface soft tissue ptosis.

The first issue of intraoral incision is limited access to the lateral orbital bone. With limited surgical view, the osteotomy can only be made in the exposed area, which is lateral on the zygomatic body rather than on the medial aspect of the zygoma. When the arch is cut and an infracture is performed, the arch and the malar complex create a sharp acute angle. This creates a square and flat malar complex (Fig. 2). An ideal facial shape is an oval shape. (**See figure, Supplemental Digital Content 3,** which shows that the ideal facial shape is an oval shape where there is a smooth curvature from the outer to the medial aspect. **http://links.lww.com/PRSGO/C789**.) Thus, to create this oval shape rather than a square and flat appearance, the osteotomy of the malar body has to be cut more medially. With the coronal approach, the dissection easily exposes the medial zygomatic complex: the lateral orbital bone. The osteotomy can be made more medially and

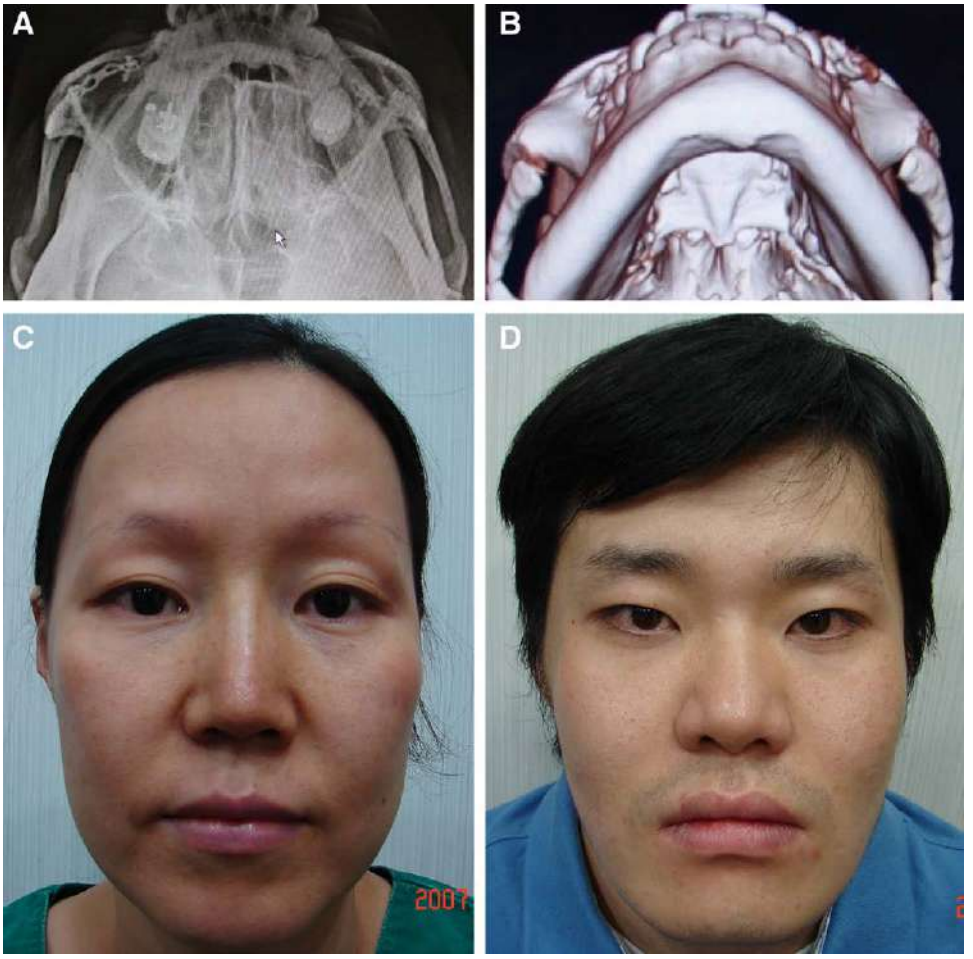

Fig. 2. The intraoral approach limits access to the medial aspect of the zygoma so only a lateral osteotomy can be performed. The lateral osteotomy of the intraoral approach creates a sharp angle of the zygomatic body as shown by the X-ray (A) and CT scan (B) images. The postoperative results (C, D) of patients who underwent intraoral approach: flat and square cheekbones.

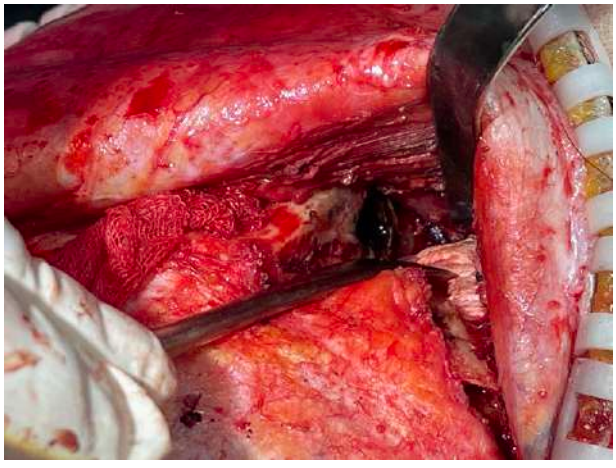

Fig. 3. The coronal approach increases exposure of the zygoma, specifically the lateral orbital bone, allowing for a medial and high osteotomy.

high (Fig. 3). Thus, upon an infracture of the bone from this osteotomy, there is a smooth converging effect from the outer side of the face toward the middle of the face (Fig. 4).

The second issue of the intraoral approach to zygoma reduction is an inadequate or unstable bone fixation. The limited upper zygoma complex exposure prevents a high zygoma bone fixation. Therefore, only a low or middle zygoma body fixation is allowed in an intraoral approach. However, during mastication, the force of mastication by the masseter muscle pulls the cut zygoma segment downward and outward. This is because the masseter muscle on the mandible is attached from the zygomatic process of the maxilla to the inferior two-thirds of the zygomatic arch. Therefore, in patients with strong mastication force, the upper zygoma osteotomy site becomes displaced laterally.[14] These patients subsequently experience a limitation of mouth opening and show depression on the malar area. to correct this malunion, a coronal approach is needed to

Fig. 4. The coronal approach provides access to the lateral orbital bone and the medial zygomatic complex for a favorable osteotomy. After the coronal approach, the postoperative X-ray (A) and the CT scan (B) images show a smooth, oval-shaped curvature of the zygomatic body. C, The preoperative frontal view of the patient's face shows a wide and lateral flaring zygoma. D, The postoperative result showing an aesthetically favorable narrowing of the zygoma. The coronal approach not only decreases the width of the cheekbones but changes the curvature of the cheekbone from square-shaped and flaring (E) to a more oval shape (F).

Fig. 5. Midface soft tissue ptosis is a significant complication with intraoral zygoma reduction. Compared with the preoperative midface (A), the postoperative result (B) shows soft tissue drooping, which occurs when the zygomatic muscles and soft tissue are detached and not resuspended.

restabilize the upper osteotomy site. Therefore, the key fixation site is the upper zygoma osteotomy region and not the middle or lower zygoma osteotomy sites. In our coronal approach series, this malunion complication was not seen, as high fixations were consistently achieved.

Cheek drooping is a significant complication that was commonly seen in our intraoral zygoma reduction patients (Fig. 5). The cheek or midface soft tissue drooping occurs because the zygomatic major and minor muscles and the soft tissue that is attached to the zygoma and zygomatic arch are de-projected after the zygoma reduction. The decrease in tension of these muscles and soft tissue makes them less taut and, therefore, ptotic. [**See figure, Supplemental Digital Content 4,** which shows that the muscles and soft tissues of the zygoma (left) are left detached with the intraoral method making them less taut and descend downward after surgery (right). **http://links.lww.com/PRSGO/C790**.] The analogy of a tent pole helps explain the concept of cheek soft tissue drooping. When the pole of the tent (the cut segment of the zygomatic bone and arch) is lowered, the tent (the zygomatic muscles and soft tissue) descends and becomes less taut or loose. However, with the coronal approach, the soft tissue and the zygomatic muscles that have been dissected can easily be reelevated with sutures. With the suture fixation of the soft tissue, the cheek soft tissue drooping does not occur. [**See figure, Supplemental Digital Content 5**, which shows that the zygomatic soft tissue and muscles (left) that are dissected with the coronal approach can be reelevated and stabilized with sutures (right), preventing postoperative midface soft tissue ptosis. **http://links.lww.com/PRSGO/C791**.] In addition, the elevation of the soft tissue and the zygomatic muscles make the face look slender and more youthful (Fig. 6). When the midface drooping occurs from an intraoral approach, ancillary surgery such as facelift does not fully correct the issue, as the fundamental problem is from zygomatic muscles and medial facial soft tissue descent.

To overcome the limitations of the standard intraoral technique, an L shape osteotomy was created for the intraoral approach.[13] An L osteotomy is more favorable than a standard straight osteotomy, as a more medial zygomatic body is cut. However, it still has the issue of potential malunion and soft tissue ptosis.

Another advantage of the coronal approach is that you can add other ancillary procedures such as forehead lifting, correction of prominent frontal sinus (decreasing forehead over protrusion), and forehead augmentation with hydroxyapatite. For patients who can benefit from these ancillary procedures, adding these procedures can markedly improve the overall cosmetic outcome.

In our series of 575 coronal cases, we experienced 466 cases (81%) of temporary alopecia and 161 cases (28%) of visible incision scars. The alopecia resolved within 1 year in all but 1% of the patients. The visible incision scars significantly improved within 1 year as well, except for 5% of the patients. There were 29 cases (5%) of temporary frontal facial nerve injury, which resolved within 3–6 months, and 12 cases (2%) of hematoma. Much of the hesitancy of the coronal approach has been due to the aforementioned complications. However, based on our follow-up of these patients, most of the negative postoperative sequelae resolved over time, whereas with the intraoral approach, the negative postoperative sequelae would require additional revision surgery, often with the coronal approach. The subsequent revision surgery with coronal approach will achieve a high bone fixation and soft tissue reelevation. However, for patients who seek correction of a flat, square zygoma from an intraoral lateral osteotomy, this revision requires a more extensive reconstruction.

CONCLUSIONS

The coronal approach to zygoma reduction is a safe and effective way to reduce the zygomatic bone and the arch over protrusion. The initial complication rates of the more open and wide dissection of the coronal approach were high, such as with alopecia, but most complications resolved within 1 year, and there were minimal significant long-term sequelae from the surgery. Compared with the more commonly performed intraoral approach, the coronal approach offers the benefits of more favorable

Fig. 6. With the coronal approach, midface soft tissue and zygomatic muscle elevation can be achieved. The preoperative photographs show significant flaring of the zygoma (A, C). The postoperative results (B, D) taken 3 years after surgery demonstrate how the coronal zygoma reduction not only effectively narrowed the cheekbones but also prevented an aged appearance with soft tissue suspension.

osteotomy, stable bone fixation, and prevention of soft tissue ptosis.

Kenneth K. Kim, MD, FACS
5757 Wilshire Blvd, Ste 349
Los Angeles, CA 90036
E-mail: kennethkimmd@gmail.com

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

The patients provided written consent for the use of their images.

REFERENCES

1. Nagasao T, Nakanishi Y, Shimizu Y, et al. An anatomical study on the position of the summit of the zygoma: theoretical bases for reduction malarplasty. *Plast Reconstr Surg.* 2011;128:1127–1138.
2. Lee HY, Yang HJ, Cho YN. Minimally invasive zygoma reduction. *Plast Reconstr Surg.* 2006;117:1972–1979.
3. Yang DB, Park CG. Infracture technique for the zygomatic body and arch reduction. *Aesthetic Plast Surg.* 1992;16:355–363.
4. Onizuka T, Watanabe K, Takasu K, et al. Reduction malarplasty. *Aesthetic Plast Surg.* 1983;7:121–125.
5. Converse, JM. Deformities of the jaws. In: Converse JM, ed. *Reconstructive Plastic Surgery.* Philadelphia: Saunders; 1977:1288.
6. Baek SM, Chung YD, Kim SS. Reduction malarplasty. *Plast Reconstr Surg.* 1991;88:53–61.
7. Kim YH, Seul JH. Reduction malarplasty through an intraoral incision: a new method. *Plast Reconstr Surg.* 2000;106:1514–1519.

8. Lee JG, Park YW. Intraoral approach for reduction malarplasty: a simple method. *Plast Reconstr Surg*. 2003;111:453–460.
9. Lee KC, Ha SU, Park JM, et al. Reduction malarplasty by 3-mm percutaneous osteotomy. *Aesthet Plast Surg*. 2006;30:333–341.
10. Jin H. Reduction malarplasty using an L-shaped osteotomy through intraoral and sideburns incisions. *Aesthet Plast Surg*. 2011;35:242–244.
11. Kook MS, Jung S, Park HJ, et al. Reduction malarplasty using modified L-shaped osteotomy. *J Oral Maxillofac Surg*. 2012;70:e87–e91.
12. Nakanishi Y, Nagasao T, Shimizu Y, et al. The boomerang osteotomy—a new method of reduction malarplasty. *J Plast Reconstr Aesthet Surg*. 2012;65:e111–e120.
13. Wang T, Gui L, Tang X, et al. Reduction malarplasty with a new L-shaped osteotomy through an intraoral approach: 418 cases. *Plast Reconstr Surg*. 2009;124:1245–1253.
14. Lee YH, Lee SW. Zygomatic nonunion after reduction malarplasty. *J Craniofac Surg*. 2009;20:849–852.