Original Article

Evaluation of Two Different Rapid Maxillary Expansion Surgical Techniques and Their Effects on the Malar Complex Based on 3D Cone-Beam Computed Tomography

P Aktop, S Biren, S Aktop1, M Motro2, C Delilbasi3, G Gurler3, G Dergin1

We compared and evaluated the effects of two techniques used for surgically assisted rapid maxillary expansion (SARME) using three-dimensional (3D) cone-beam computed tomography, focusing on changes in soft and hard tissue in the malar region. A conventional Le Fort I osteotomy group (10 patients, mean age: 19.3 years) and a high Le Fort I group (12 patients, mean age: 20.4 years) underwent 3D analyses. Changes in hard and soft tissue of the malar region were compared. The average increases in the bone malar width and soft malar width in the high Le Fort I group between the pre- and postoperative periods were 1.43 ± 1.23 and 1.39 ± 1.19 mm, respectively. The average increases in the bone malar depth on the right and left sides in the high Le Fort I group were 1.34 ± 0.81 and 1.60 ± 0.54 mm, respectively. Progress in hard tissues did not reflect significant changes in soft tissue.

Context: Effects of high Le Fort I SARME on the malar complex.

Aims: To compare and evaluate the effects of two techniques used for SARME, using 3D cone-beam computed tomography, focusing on changes in hard and soft tissues in the malar region.

Settings and Design: A conventional Le Fort I osteotomy group (10 patients, mean age: 19.3 years) and a high Le Fort I group (12 patients, mean age: 20.4 years).

Methods and Material: Each group underwent 3D analyses, and changes in hard and soft tissues of the malar region were compared.

Statistical Analysis Used: The SPSS software (ver. 15.0 for Windows) was used. The Kolmogorov-Smirnov test, Student’s t test, and paired-samples test were conducted.

Results: The average increases in the bone malar width and soft malar width in the high Le Fort I group between the pre- and postoperative periods were 1.43 ± 1.23 and 1.39 ± 1.19 mm, respectively. The average increases in the bone malar depth on the right and left sides in the high Le Fort I group were 1.34 ± 0.81 and 1.60 ± 0.54 mm, respectively.

Conclusions: Progress in hard tissues did not reflect significant changes in soft tissue.

Key Messages: Effects of high Le Fort I SARME on the malar complex

Keywords: High Le Fort I, malar deficiency, surgically assisted rapid maxillary expansion

INTRODUCTION

A transverse maxillary discrepancy (TMD) is one of the most common dentoskeletal problems encountered in clinical orthodontics. TMD, isolated or associated with other dentofacial deformities, results in aesthetic and functional impairment, such as difficulty chewing, dental clustering, and nasal blockage, leading to buccal breathing and apnea. TMD often presents...
Patients with both TMD and a lack of a malar eminence of the malar mound has been suggested to be a point of the malar mound in any view. The malar line of the malar mound is known to define the contours of the malar complex. Indeed, to treat TMD, several attempts to orthopedically alter the transverse dimensions of the maxilla with advancing age, surgical procedures have been proposed based on the theoretical and practical assumption that a broad maxilla is associated with increased thickness of bones, with reduced elasticity, and unwanted adverse effects, such as lateral tipping of the posterior teeth, buccal fenestrations, failure to open posterior teeth, pain, instability, and root resorption.

SARME can be used to treat TMD but not malar deficiencies. We compared and evaluated the effects of two SARME techniques on the malar complex, namely, we performed a conventional Le Fort osteotomy with a conventional versus a high Le Fort I osteotomy line. The evaluation was made using three-dimensional (3D) cone-beam computed tomography (CBCT), focusing on changes in hard and soft tissues in the malar region in terms of malar depth and width. CBCTs were obtained before SARME and 12 months after treatment; SARME was included as part of an initial approach to orthodontic treatment. SARME was performed either according to which surgical protocol was used: a Le Fort I osteotomy without a down fracture had been performed under general anesthesia. In the high Le Fort I group; no underlying systemic comorbidities were detected. Patient selection criteria were skeletally mature/adult; TMD with unilateral/bilateral posterior cross-bite; MD was usually characterized by paranasal hollowing and decreased projection of the malar eminence, causing MD, are currently treated with obliteration of the maxillary sutures, which accompany increased thickness of bones, with reduced elasticity, and effects on maxillary skeletal structures, because of the depth that can be assessed. Maxillary hypoplasia is often associated with a deep paranasal triangle. This triangle represents the paranasal triangle, in which the depth can be assessed.

We recruited from the Department of Orthodontics at the university's Faculty of Dentistry. All subjects were Caucasians, from the same geographic area. Informed consent forms were signed by the parents or guardians of all patients. This was a retrospective study, approved by the local Health Sciences Ethical Committee.

Aktop, et al.: Outcomes of High Le Fort I SARME on Malar Complex

Aktop, et al. have discussed the exact location of the malar complex and have reviewed the techniques that have been proposed to correct malar eminence deficiencies. Aktop, et al. have focused on the clinical evaluation of the malar eminence, which is defined as the point below the lateral canthus, which gives the flat malar eminence.
A modified high Le Fort I maxillary osteotomy was performed in the high Le Fort I group [Figure 3], as previously described. Midfacial skeleton exposure was accomplished through an intraoral labiobuccal incision above the attached gingiva, from first molar to first molar. The anterior maxillary wall and inferior orbital foramen was exposed with a subperiostal dissection superiorly and the dissection was continued to the lateral zygomatic-maxillary buttress and the anterior portion of the zygomatic arch. The whole surgical region was identified with a superior–posterior subperiosteal elevation. After the nasomaxillary buttress, the pyriform aperture and the anterior nasal spine were exposed anteriorly, and the pterygoid plates were exposed with a subperiostal dissection posteriorly. Lateral nasal walls below the inferior turbinate and septum were exposed with an intranasal dissection. Before the modified high Le Fort I maxillary osteotomy was performed, the osteotomy line was marked with a #14 round bur. Horizontal osteotomies, proceeding from the anterior portion of zygomatic bone through the posterior-lateral maxillary wall, 5 mm below the infraorbital foramen, to the lateral nasal wall, across the anterior maxillary wall, were accomplished with a reciprocating saw, directed posterior to anteriorly, following the previously marked osteotomy line [Figure 4]. Vertical cuts down to the most distal part of horizontal osteotomy on the zygomatic bone were performed with an oscillating saw, angled at 45° anterio-posteriorly in the coronal plane, to allow segment sliding over the zygoma in distraction [Figure 5]. Sliding of the distal portion of bone segment on the zygoma pushes or bends the distal portions of the distracted bone forward, augmenting the malar deficiency while correcting the transverse insufficiency [Figure 6a] and [Figure 6b]. To separate the nasal septum and vomer from the maxillary crest, a septal osteotome was used to prevent nasal septum deviation after distraction. A curved osteotome was used to separate the pterygoid plate from the maxillary tuberosity. Finally, a midpalatal split, from the anterior to the posterior nasal spine, was performed with an osteotome [Figure 7].

After the osteotomy was complete, the hyrax appliance was activated to check that it worked properly and this was followed by immediate regression, leaving a 1-mm gap, instead of the osteotome. The patients received postoperative prophylactic antibiotics (cefazolin sodium 1 g IM BID, Sefazol, Mustafa Nevzat) and analgesics (tenoxicam 20 mg BID, Oksamen, Mustafa Nevzat) for 7 days postoperatively.

Postoperative protocol

Three days after the surgery, the patients’ parents/guardians were taught how to turn the screw and activate the expansion appliance. They were instructed to activate it twice per day; per activation, a ¼-turn of the hyrax screw expanded the cap-splint by 0.25 mm. Thus, 0.5 mm of expansion daily was expected. Expansion was ended when the palatal cusps of the maxillary molars coincided with the buccal cusps of the antagonist mandibular molars. Then, the patients were examined monthly for the 6-month retention period.

At the end of this phase, the cap-splint was removed and a fixed transpalatal arch with arms extending along the palatal aspects of the premolars and canines was placed. Records were taken before and 12 months after surgery for comparison. Records obtained included intra- and extraoral photographs and 3D CBCT images. 3D CBCT images were captured using an ILUMA CBCT scanner.
Preoperative and postoperative (12 months after SARME), hard and soft tissue 3D data were collected and compared for each patient. CBCT images were analyzed using the Mimics software. Table 1 shows changes in SMW and BMW before and after expansion. The average increases in the BMW and SMW values in the high Le Fort I group between the pre- and postoperative periods

**RESULTS**

To ensure that linear measurements in 3D format were accurate and repeatable, measuring planes were defined as the starting control measuring point. First, from a lateral view, a vertical plane perpendicular to the Frankfort horizontal plane passing through the posterior border of the orbital extension of zygomatic bone, which represents the lateral wall of the orbit, was created, thus separating two halves of the head, anterior, and posteriorly (Plane A). Second, continuing from the lateral view, a horizontal plane parallel to the Frankfort horizontal plane, passing through the inferior border of the articular eminence, was made to separate the upper and lower halves of the head (Plane B). The new constructed image allowed measurement of transverse changes in bone malar width (BMW) and soft tissue malar width (SMW) before and after SARME.

To measure anteroposterior changes in the malar region, new vertical planes were defined in the left and right segments separately. From the frontal view, a vertical line passing through intersection of the frontozygomatic suture and the superior border outline of the orbit were made (Plane C). After removing the lateral halves, linear anteroposterior changes in the malar region were measurable using the intersecting point of all three planes as the starting control point [Figure 8].

**3D measurements**

Measurements of BMW and SMW were made by analyzing Planes A and B [Figure 9a] and [Figure 9b]. How these changed anteroposteriorly was assessed by analyzing Plane C on the right and left sides separately [Figure 10a] and [Figure 10b].

**Statistical evaluation**

The SPSS software (ver. 15.0 for Windows) was used for statistical analyses. Conformity of parameters to a normal distribution was assessed using the Kolmogorov–Smirnov test. The Student’s *t* test was used for comparisons of descriptive statistics and comparisons of parameters with normal distributions between two groups. The paired-samples *t* test was used for in-group comparisons of parameters with normal distributions.
were 1.43 ± 1.23 and 1.39 ± 1.19 mm, respectively; these changes were significant in the high Le Fort I group ($P = 0.002$ and 0.002, respectively). There were no significant changes in BMW or SMW in the conventional Le Fort I group between the pre- and postoperative periods ($P = 0.742$ and 0.227, respectively).

Table 1: In-group and intergroup BMW and SMW evaluations

<table>
<thead>
<tr>
<th></th>
<th>High LeFort I</th>
<th>LeFort I</th>
<th>$P^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
</tr>
<tr>
<td>BMW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>107.24 ± 5.47</td>
<td>106.05 ± 6.49</td>
<td>0.646</td>
</tr>
<tr>
<td>Postop</td>
<td>108.68 ± 5.79</td>
<td>106.08 ± 6.38</td>
<td>0.330</td>
</tr>
<tr>
<td>Difference</td>
<td>1.43 ± 1.23</td>
<td>0.29 ± 0.27</td>
<td>0.742</td>
</tr>
<tr>
<td></td>
<td>0.002**</td>
<td>0.462</td>
<td></td>
</tr>
<tr>
<td>SMW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>125.58 ± 7.10</td>
<td>126.55 ± 5.41</td>
<td>0.728</td>
</tr>
<tr>
<td>Postop</td>
<td>126.97 ± 7.47</td>
<td>126.68 ± 5.32</td>
<td>0.919</td>
</tr>
<tr>
<td>Difference</td>
<td>1.39 ± 1.19</td>
<td>0.18 ± 0.46</td>
<td>0.002**</td>
</tr>
<tr>
<td></td>
<td>0.002**</td>
<td>0.227</td>
<td></td>
</tr>
</tbody>
</table>

BMW = bone malar width, SMW = soft tissue malar width. *Student t test. **Paired sample t test. **$P < 0.01$.

Table 2: In-group and intergroup R-BMD and L-BMD evaluations

<table>
<thead>
<tr>
<th></th>
<th>High LeFort I</th>
<th>LeFort I</th>
<th>$P^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
</tr>
<tr>
<td>R-BMD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>8.10 ± 1.94</td>
<td>6.00 ± 2.95</td>
<td>0.06</td>
</tr>
<tr>
<td>Postop</td>
<td>9.44 ± 2.14</td>
<td>6.10 ± 2.84</td>
<td>0.005**</td>
</tr>
<tr>
<td>Difference</td>
<td>1.34 ± 0.81</td>
<td>0.10 ± 0.34</td>
<td>0.359</td>
</tr>
<tr>
<td></td>
<td>0.001**</td>
<td>0.328</td>
<td></td>
</tr>
<tr>
<td>L-BMD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>8.35 ± 2.11</td>
<td>7.65 ± 2.47</td>
<td>0.478</td>
</tr>
<tr>
<td>Postop</td>
<td>9.96 ± 2.21</td>
<td>7.75 ± 2.47</td>
<td>0.039*</td>
</tr>
<tr>
<td>Difference</td>
<td>1.60 ± 0.54</td>
<td>0.10 ± 0.32</td>
<td>0.001**</td>
</tr>
<tr>
<td></td>
<td>0.001**</td>
<td>0.328</td>
<td></td>
</tr>
</tbody>
</table>

R-BMD = bone malar depth. *Student t test. **Paired sample t test; **$P < 0.01$; *$P < 0.05$.

Figure 4: Horizontal osteotomy, proceeding from the anterior portion of the zygomatic bone through the anterior maxillary wall below 5 mm from the infraorbital foramen.

Figure 5: A 45° anterio-posteriorly angled osteotomy in the coronal plane.

Figure 6: (a) Preoperative 3D image. Red arrow in the yellow circle shows the state of the malar complex before surgery. (b) Postoperative 3D image. Red arrow in the yellow circle shows the forward movement of the osteomized malar segment after expansion.
increases in BMD on the right and left sides in the high Le Fort I group were $1.34 \pm 0.81$ and $1.60 \pm 0.54$ mm, respectively ($P = 0.001$ and $0.001$, respectively). There were no significant changes in the right or left BMD values in the conventional Le Fort I group between the pre- and postoperative periods ($P = 0.359$ and $0.328$, respectively). There were significant differences between the postoperative right and left BMD values of the high and conventional Le Fort I groups ($P = 0.005$ and $0.039$, respectively). There were positive changes in the SMD on the right and left sides in both groups, but none of them were statistically significant.

Table 4 shows the results of an evaluation of the degree of palatal expansion, where there were significant changes from pre- to postoperative in both groups. There were no significant differences in the total palatal expansion between the groups.

### Table 3: In-group and intergroup R-SMD and L-SMD evaluations

<table>
<thead>
<tr>
<th></th>
<th>High LeFort I</th>
<th>LeFort I</th>
<th>$P^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R-SMD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>17.68 ± 3.37</td>
<td>18.17 ± 2.81</td>
<td>0.719</td>
</tr>
<tr>
<td>Postop</td>
<td>18.64 ± 2.97</td>
<td>18.43 ± 2.64</td>
<td>0.864</td>
</tr>
<tr>
<td>Difference</td>
<td>0.95 ± 1.88</td>
<td>0.25 ± 0.46</td>
<td></td>
</tr>
<tr>
<td>$P^b$</td>
<td>0.100</td>
<td>0.115</td>
<td></td>
</tr>
<tr>
<td><strong>L-SMD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>18.52 ± 3.10</td>
<td>19.71 ± 2.72</td>
<td>0.356</td>
</tr>
<tr>
<td>Postop</td>
<td>19.28 ± 3.01</td>
<td>20.00 ± 2.49</td>
<td>0.559</td>
</tr>
<tr>
<td>Difference</td>
<td>0.76 ± 2.19</td>
<td>0.28 ± 0.45</td>
<td></td>
</tr>
<tr>
<td>$P^b$</td>
<td>0.253</td>
<td>0.78</td>
<td></td>
</tr>
</tbody>
</table>

SMD = soft tissue malar depth  

$a$ Student t test  

$b$ Paired sample t test

### Table 4: Evaluations of AAW

<table>
<thead>
<tr>
<th></th>
<th>High LeFort I</th>
<th>LeFort I</th>
<th>$P^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AAW</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>48.99 ± 4.48</td>
<td>50.96 ± 6.32</td>
<td>0.48</td>
</tr>
<tr>
<td>Postop</td>
<td>54.82 ± 5.54</td>
<td>54.67 ± 5.74</td>
<td>0.951</td>
</tr>
<tr>
<td>Difference</td>
<td>5.83 ± 4.51</td>
<td>3.70 ± 2.21</td>
<td></td>
</tr>
<tr>
<td>$P^b$</td>
<td>0.001**</td>
<td>0.001**</td>
<td></td>
</tr>
</tbody>
</table>

AAW = Alveolar Arch Width  

$a$ Student t test  

$b$ Paired sample t test  

* $P < 0.05$  

** $P < 0.01$
A high Le Fort I osteotomy associated only with maxillary advancement and alveolar distraction has been reported before. In 1991, Norholt et al. performed an extended Le Fort I osteotomy to correct midfacial hypoplasia in 35 patients, seven of which had cleft palates. After 37 months, the treatment results were clinically stable, with good occlusion. Moreover, masticatory function improved and patients reported satisfactory aesthetic results. In the following years, reported cases of high Le Fort I osteotomies increased, with special attention to cleft patients, particularly because they present with further midfacial hypoplasia. However, the main limitation to this procedure was a lack of osseous healing due to involvement of larger bone movement. This problem was later solved, as demonstrated by Ren et al., who added bone grafting immediately after performing a high Le Fort I osteotomy in cleft patients with secondary MDs.

Patients with an MD with a low malar prominence tend to have a gaunt or hollow midface, leading to a perpetually tired, worn out, older, and sad appearance. This was further supported by McCance et al., who reported similar changes in their study of changes in bone following orthognathic surgery. Past studies have shown that SARME causes forward movement of the maxilla due to the buttress effect. Based on this evidence, a high Le Fort I SARME might be considered beneficial for maxillary retrognathia patients, particularly because it has the potential to improve a malar deficiency. The use of minor modifications of routine surgical procedures in conventional orthognathic surgery can improve aesthetic results in patients with midfacial hypoplasia. A high Le Fort I SARME might be considered a new combination of a surgical and an orthodontic procedure.

**Figure 10:** (a) A 3D frontal, oblique, infero-axial, and sagittal view of a new soft tissue region created to measure anteroposterior changes in the malar region. (b) Measurements made in the limit of the latero-inferior border plane of the new soft tissue region that had developed, as seen from the 3D sagittal view. Changes in bone malar depth (BMD) and soft tissue malar depth (SMD) were measured in this manner.

**DISCUSSION**

Powell et al. demonstrated that the height of the malar contour vertically was just at or below the Frankfort horizontal plane. Then the malar eminence was divided into anteromedial and posterolateral segments by drawing (i) a vertical line passing through the lateral canthus; (ii) a vertical line passing through the soft tissue nasion and pronasale, thus bisecting the midnasal line; (iii) a diagonal line from the ala to the lateral canthus; (iv) a line parallel to the earlier third line, running through the commissure; and finally (v) the horizontal Frankfort plane. This classification is significant because it defines the types of malar deficiency. Malar defects may be categorized as anteromedial, posterolateral, or a combination of both. However, we needed to develop our own analysis technique and measurable planes, because previous studies and cases have not evaluated the malar complex in three dimensions.

Nkenke et al. observed that maxillary advancement resulted in a more pronounced shifting of the soft tissues in the malar midfacial area than the upper lip. This was further supported by McCance et al., who reported similar changes in their study of changes in bone following orthognathic surgery. Past studies have shown that SARME causes forward movement of the maxilla due to the buttress effect. Based on this evidence, a high Le Fort I SARME might be considered beneficial for maxillary retrognathia patients, particularly because it has the potential to improve a malar deficiency. The use of minor modifications of routine surgical procedures in conventional orthognathic surgery can improve aesthetic results in patients with midfacial hypoplasia. A high Le Fort I SARME
There are many limitations when using traditional 2D radiography to evaluate the dentomaxillary complex, such as the superimposition of lateral and midline anatomical structures. With the decreased ionizing radiation and increasing popularity of CBCT, the opportunity exists for orthodontists and other researchers to evaluate changes resulting from SARME on the maxillary complex in a living person, unlike previous studies that have relied on computer models. In addition, 3D imaging allows the evaluation of the craniofacial complex at various levels without the superimposition of structures that occurs with traditional 2D radiography.[28] Moreover, manual superimposition using computers may result in errors; Grybaskas et al.[29] mentioned that measurements with manual superimposition caused errors up to 0.4 mm, although half of those were less than 0.3 mm.

Other studies have suggested that a high Le Fort I level osteotomy not only provides maxillary advance but also advances regions of the lateral region and floor of the nose and partial infraorbital region of the face.[14,30] Kim et al.[31] investigated changes in midfacial soft tissue after advancement of the maxilla with high Le Fort I osteotomy and mandibular set back surgery and found that changes in soft tissue were concentrated just below the infraorbital foramen. The distribution of the affected soft tissue after the high Le Fort I osteotomy was within the rectangular malar region between the two infraorbital forams and the upper lip. They claimed that conventional and high Le Fort I osteotomies induced an overall hard to soft tissue response in the midfacial area, but Ryckman et al.[32] noted that facial soft tissues appeared to respond more to the anterior movement of the jaws than to an increase in transverse dimensions after maxillomandibular advancements. In contrast to Ryckman, we found that facial soft tissues appeared to respond more to transverse movement of the jaws than to an increase in sagittal dimensions.

In our study, the average increases in BMW and SMW were 1.43 and 1.39 mm in the high Le Fort I group and 0.29 and 0.18 mm in the conventional group, respectively. Changes in BMW seemed to be reflected by the soft tissue, in that SMW values also showed a statistically significant increase in the high Le Fort I group. The increases in both the right (1.34 mm) and left BMD (1.60 mm) were significant, but changes in the soft tissue in both right (0.95 mm) and left SMD (0.76 mm) were less than expected and not significant. The reason for this may be nutritional deficiencies caused by the hyrax device and associated weight loss.

Ramieri et al.[33] examined changes in soft tissue in transverse palatal distraction patients, and reported 1-3 mm of progress in the paranasal region but not in the malar bones; they also claimed that this progress decreased medially to laterally. Our study has similarities with previous studies in that we did not detect any significant increases in average BMW or SMW (0.29 and 0.18 mm, respectively), BMD (1.34 mm on the right, 1.60 mm on the left), or SMD (0.95 mm on the right, 0.76 mm on the left) in the conventional Le Fort I group. Moreover, BMD progress did not reflect SMD in our 3D analyses.

Baik and Kim[34] studied maxillary advancement in class III orthognathic surgery patients and performed 3D soft tissue analyses. They reported more progress in the midfacial region of the face than the lateral region. In the present high Le Fort I cases, we found that both BMW and BMD were higher postoperatively than preoperatively.

We gained 6.71 mm of average palatal expansion in the high Le Fort I group and 5.73 mm in the conventional group. Patients who gain maxillary advancement ≥4.0 mm experience a larger increase in the greatest interalar width than those with maxillary advancements <4.0 mm.[32] We did not detect any statistically significant differences between total palatal expansion in the groups, so we suggest that the amount of expansion produced by the appliance was standardized. Otherwise, a nonstandardized expansion could create problems because one surgical group might have received more expansion than the other and biased the results. Comparison of the 6.71 mm expansion in the high Le Fort I group with the BMW (1.43 mm) and BMD (right 1.34 mm, left 1.60 mm) values showed no direct effect and indicated poor improvement in the augmentation target area. In addition, this poor reflection of hard tissue changes by the soft tissues in terms of malar depth makes the procedure questionable in terms of effort versus benefit.

In the cases described, we found that both BMW and BMD were higher postoperatively than preoperatively in the high Le Fort I group. An SARME with a high Le Fort I osteotomy design, including the malar bones, can be beneficial for malar deficiency treatment with a high degree of expansion, while correcting transverse maxillary problems. Further clinical studies with more patients are needed to fully evaluate the clinical outcomes of this technique.

The resulting increases in BMW and SMW in the high Le Fort I group were statistically significantly higher than in the conventional group. The resulting hard tissue malar anteroposterior progress in the high Le Fort I group was also statistically significantly higher. However, progress in hard tissues did not reflect significant changes in soft tissue. A greater degree of expansion could lead to better malar progress.
Financial support and sponsorship
Nil

Conflicts of interest
There are no conflicts of interest

REFERENCES