

# Le Fort I Osteotomy



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## KEYWORDS

• Le Fort I osteotomy • Maxillary segmentation • Le Fort I geometry modifications

## KEY POINTS

- The osteotomy design in a Le Fort I significantly impacts the ability to reposition the maxilla 3-dimensionally.
- The surgical technique presented allows for efficiency in completion of the osteotomies.
- Sequencing for segmentation as well as segmentation schemes will be presented so that 3-dimensional problems in the maxilla can be individually addressed.
- Control of the vertical dimension in the Le Fort I is critical to ensure accurate transposition of the surgical treatment plan to the executed surgical procedure.

## Introduction

The desire to mobilize the maxilla through an osteotomy dates back to more than 150 years ago. Von Langenbeck<sup>1</sup> discussed the utilization of a maxillary osteotomy to facilitate nasal polyp removal in 1859. Cheever<sup>2</sup> in 1876 similarly discussed down fracture of the hemi maxilla for clearing the nasal cavity of an obstructing lesion. The concept or desire for movement and repositioning of the maxilla was not Von Langenbeck's or Cheever's goal; however, the thought process of freeing the maxilla from a fixed position was described.

In 1901, Le Fort<sup>3</sup> helped to bring clarity to the natural cleavage planes of the facial skeleton. By defining the level I cleavage plane of the maxilla from the cranial base, predictable manipulation of the maxilla could be planned for treatment of a malpositioned maxilla. In fact, in 1927 Wassmund<sup>4</sup> discussed the technique for mobilization of the maxilla but did not include separation of the pterygoid plates. Schuchardt<sup>5</sup> in 1942 reported the successful advancement of the maxilla via separation from the pterygoid plates and complete down fracture after an unsatisfactory attempt without pterygoid plate separation.

By the late 1960s and early 1970s, Bell<sup>6</sup> capitalized on the ability to mobilize the maxilla and discussed segmentalization for the facilitation of orthodontic treatment goals as well as described the vascular supply, which permitted these surgical movements. In the 1980s, continued refinement of the Le Fort I osteotomy procedure focused on techniques to facilitate postoperative stability. Kaminishi and colleagues<sup>7</sup> discussed carrying the osteotomy cut high into the dense cortical bone of the zygomaticomaxillary buttress to facilitate postoperative stability and internal fixation. Bennett and Wolford<sup>8</sup> further advocated the step osteotomy of the maxilla to avoid unwanted vertical movement from an angulated nonstepped osteotomy of the maxilla. Their design kept the anterior and

posterior maxillary osteotomies parallel to one another with the step at a right angle near the buttress. Reyken and Masuriek,<sup>9,10</sup> somewhat conversely, advocated a sloped osteotomy for inferior anterior maxillary repositioning with its goal being improved bony contact during inferior repositioning of the maxilla.

The versatility of the Le Fort I osteotomy to correct maxillary deformities is unquestioned. As a result, the osteotomy design has undergone modification to enhance the ability of the surgeon to accurately reposition the maxilla and to improve bony contact and logically the initial stability of the mobilized jaw. The technique I will describe further enhances bony contact by increasing bony surface area while decreasing osteotomy gaps along the buttress and posterior maxilla.

## Surgical technique

### Preoperative planning

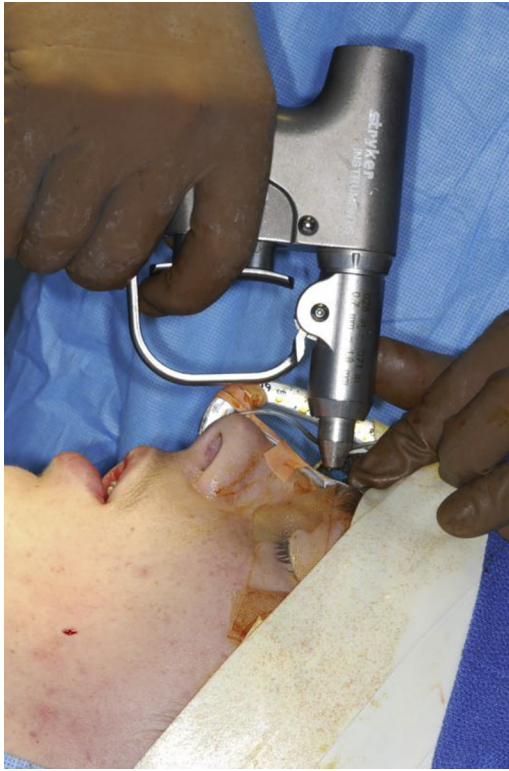
Execution of the surgical procedure is best done with controlled hypotension, the use of local anesthesia with vasoconstrictor and nasotracheal intubation. It is important that the smallest endotracheal tube, which meets the necessary length requirement to pass through the vocal cords without impingement of the balloon on the cords, should be used. It is important, especially at the termination of the case when closing, that there is the ability to have control of the diameter of the nares as well as the alar base.

The endotracheal tube should be secured passively in such a way that there is no upward or cephalad traction on the nose causing any distortion that would impact the ability to get an appropriate recapitulation of the nasal base or enhance it in cases where it is excessively wide, narrow, or asymmetric.

Establishment of a preoperative vertical dimension is essential whether the maxilla is to be moved superiorly or inferiorly any vertical changes can be accounted for. Errors will impact the patient's tooth-to-lip display. External markers have shown to be the most effective in controlling the vertical dimension. I prefer a .045" Steinmann pin, which is inserted in the nasal bridge at soft tissue nasion (Fig. 1).

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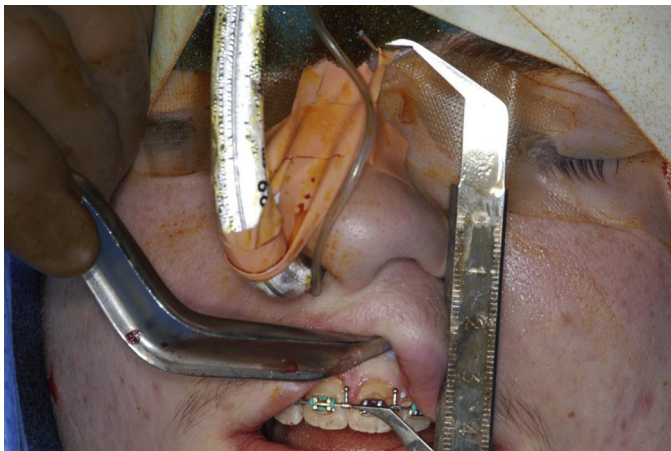
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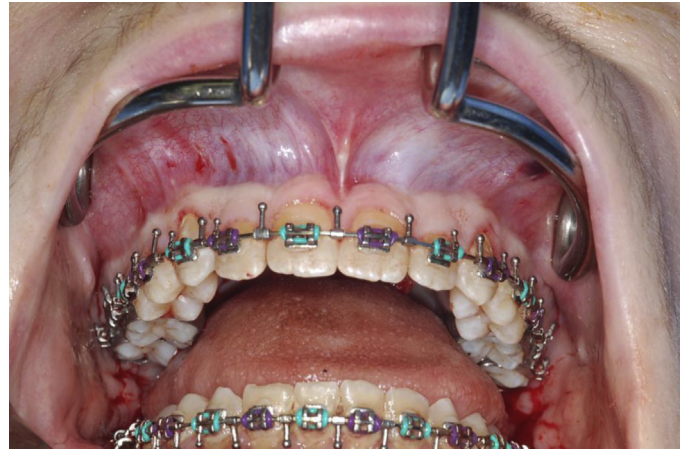
**Fig. 1** External reference pin place in the bridge of the nose.

The measurement of the vertical dimension is made from the pin to the arch wire. This will ensure that maximum control intraoperatively can be obtained so that your planned vertical change can be accurately obtained. A Marshac caliper, or Boley gauge, will suffice in recording this measurement (**Fig. 2**).

Incisions for a Le Fort I osteotomy should be made using complete vestibular retraction with an appropriate retractor that will fit across the entire arch (**Fig. 3**). Whether one uses electrocautery or scalpel can be left to the surgeon's preference; however, I find that the Colorado tip provides for good hemostasis, minimal thermal damage, and surgical precision. The initial incision should be placed at a minimum of 5 mm above the mucogingival junction, leaving an adequate amount of movable mucosa for final closure.



**Fig. 2** Preoperative measurement is recorded. External measurements are more accurate than internal measurements and more reproducible.



**Fig. 3** Good vestibular retraction is essential for making the mucosal incision.

Keep in mind that the soft tissue will retract somewhat, so a generous collar of soft tissue should be accounted for. It is my preference to make an incision from the embrasure of the first molar to embrasure of the opposite first molar through mucosa and muscle with the periosteum being incised with a #15 blade (**Fig. 4**). Once this has been accomplished, the entire maxilla is exposed with a mucoperiosteal elevator and Obwegeser curved out right angle retractors being inserted behind the buttress and engaging the pterygomaxillary juncture (**Fig. 5**).

An adequate amount of reflection must take place to allow for placement of your rigid fixation once the maxilla has been repositioned. To facilitate reflection of the nasal mucosa, I find that disarticulation of the septum from the anterior nasal spine is most helpful. The nasal septum can be easily disarticulated by use of a right angle notched retractor by engaging septum at the junction of the anterior nasal spine. Using cephalad and slight posterior traction the septum will disarticulate from the maxillary crest and anterior nasal spine and initiate the elevation of the mucoperiosteum from the anterior floor of the nasal cavity (**Fig. 6**).

A nasal freer is then used to complete the remaining reflection of the nasal mucosa. It is important that the mucoperiosteum be reflected from the entire lateral nasal wall, nasal floor, and off the septum bilaterally. This will minimize tears to the nasal mucosa during the osteotomies. Using this technique oftentimes will preclude the need for any nasal mucosa repair following down fracture (**Fig. 7**). The proposed geometry of the Le Fort I osteotomy now can be clearly visualized and even premarked using a sterile pencil so that there is symmetry, appropriateness in the height bilaterally, and location of the buttress cut such that tooth roots can be avoided (**Fig. 8**).

A nasal mucosa retractor is then inserted at the piriform rim between the base of the rim and the inferior turbinate to protect the turbinate from the reciprocating saw, which is used to make the anterior maxillary wall and the lateral nasal wall cut (**Fig. 9**). A reciprocating saw will easily pass through the thin maxillary bone. As it is swept medially and then superiorly, the lateral nasal wall will also be osteotomized. Many times this method precludes the use of other osteotomes before down fracture (**Fig. 10**).

The buttress cut has been modified from how it has been described in the literature. Historically, a right angle stepped buttress cut has been used; however, that leaves a very

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