

# “Twist Technique” for Pterygomaxillary Dysjunction in Minimally Invasive Le Fort I Osteotomy

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**Purpose:** To present a new technique for effective, rapid, and safe pterygomaxillary dysjunction in the context of a minimally invasive Le Fort I protocol and to provide the authors' preliminary experience.

**Materials and Methods:** In total, 1,297 consecutive patients underwent Le Fort I osteotomy as an isolated procedure or in combination with mandibular surgery. In all cases, the “twist technique” was used to downfracture the maxilla. This method achieves pterygomaxillary dysjunction using a frontal approach and a straight osteotome that is driven along the standard Le Fort I horizontal osteotomy toward the pterygomaxillary junction. Downfracture is achieved by inwardly rotating the osteotome fixed at the zygomatic buttress.

**Results:** The studied sample consisted of 820 women and 477 men (mean age, 28.4 years). Mean surgical time of the maxillary procedure was 44 minutes. Mean incision length was 2.8 cm. No significant neurovascular complications or clinically evident iatrogenic fractures occurred. Mean maxillary advancement was 5.5 mm (range, 2.0 to 14.0 mm).

**Conclusions:** Compared with classic pterygomaxillary dysjunction, the twist technique uses a frontal approach and a straight osteotome. This technical modification requires a substantially smaller incision, achieves an immediate effective separation of the maxilla, and enables adequate visualization of the palatine neurovascular bundle. The authors' preliminary experience in 1,297 patients shows the technique's safety and efficacy.

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In experienced hands, Le Fort I maxillary osteotomy currently is a safe, reliable, and predictable procedure.<sup>1</sup> The development of specific surgical instruments, an increased knowledge of the biology of this particular osteotomy, and optimal anesthesiology conditions have significantly decreased its former morbidity and duration.<sup>2-6</sup>

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Successful mobilization of the maxilla during Le Fort I osteotomy requires an effective separation of the maxilla from the pterygoid process of the sphenoid bone. This dysjunction must be clean and precise to avoid neurovascular complications and potential skull base structures.<sup>4,7-9</sup> The aim of this report is to present a new technique for effective, rapid, and safe pterygomaxillary dysjunction in the context of a minimally invasive Le Fort I protocol and to describe the authors' preliminary experience with this procedure.

## Materials and Methods

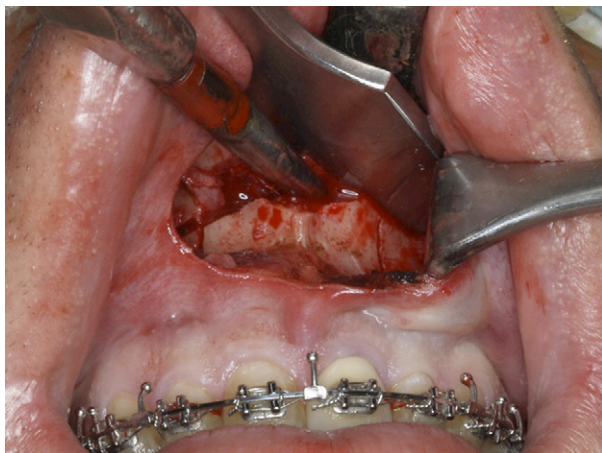
From January 2000 to January 2012, 1,297 consecutive nonsyndromic patients underwent Le Fort I osteotomy as an isolated procedure or in combination with mandibular surgery at the authors' center. A minimally invasive Le Fort I protocol was followed. This protocol is described in detail in the next section. In particular, the “twist technique” was used to

downfracture the maxilla in all cases. Patients in whom significant scar tissue or abnormal anatomy was anticipated, such as cleft patients or syndromic cases, received a modified incision and were not included in this study. Guidelines from the Declaration of Helsinki were followed at all treatment phases.

After a 12-year period, a retrospective evaluation of patients who underwent this surgical protocol was performed. Being a retrospective analysis, the study was exempt from institutional review board approval.

#### SURGICAL TECHNIQUE

The procedure was performed under general anesthesia and controlled hypotension. Through a minimally invasive incision from lateral incisor to lateral incisor, the nasal spine was osteotomized from the maxilla with a sharp 0.5-cm osteotome. After this subspinal osteotomy, the nasal mucosa was detached from the nasal floor with a periosteal elevator. Using the latter, the nasal septum was luxated laterally to separate it from the nasal crest of the maxilla. Subsequently, standard Le Fort I horizontal osteotomies were performed with a reciprocating saw with a 4-cm blade. Posteriorly, the cut was slanted slightly downward toward the maxillary tuberosity. The medial walls of the maxillary sinuses were cut as the reciprocating saw proceeded medially. Lateral osteotomies were completed by driving a sharp, straight, 2-cm osteotome from the nasal crest of the maxilla to the pterygomaxillary junction (Fig 1). A classic pterygomaxillary dysjunction from a lateral approach (ie, driving a curved osteotome at the pterygomaxillary fissure) was not performed. Instead, a straight osteotome was driven through the horizontal osteotomy from the pyriform buttress back to the junction



**FIGURE 1.** The osteotome is driven from the nasal crest of the maxilla toward the pterygomaxillary junction. A narrow periosteal elevator (left) is used to protect the nasal mucosa.

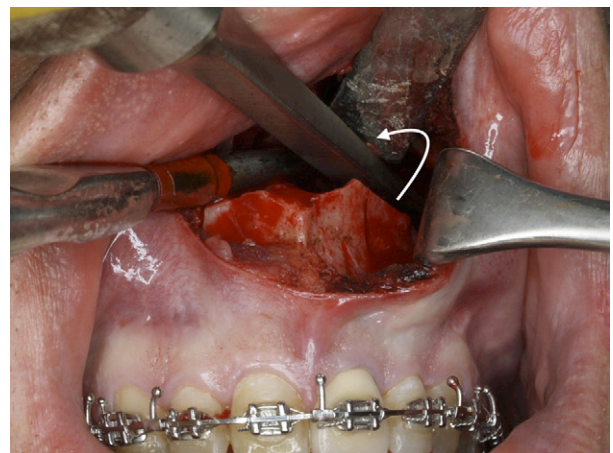
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**FIGURE 2.** Skull base model. The osteotome progresses along the horizontal osteotomy from the pyriform buttress back to the pterygomaxillary junction.

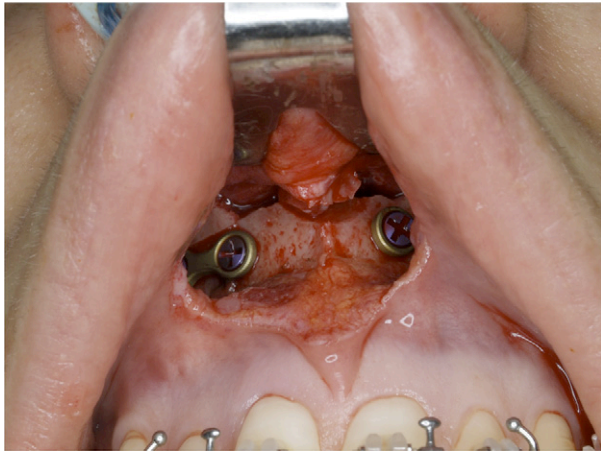
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of the posterior wall of the maxillary sinus to the pterygoid plates (Fig 2). Subsequently, once the osteotome was fixed at the pterygomaxillary junction and underneath the zygomatic buttress, it was rotated inwardly, thus provoking downfracture of the maxilla (Fig 3). No mallet pressure was used during this maneuver. Rather, a swift twist of the chisel under controlled manual force led to an immediate vertical separation of the maxilla from the cranial base. Once the pterygomaxillary dysjunction was completed at one side, the twist technique was repeated at the contralateral side. For complete mobilization of the maxilla, the palatine neurovascular bundles were liberated with the aid of a piezoelectric saw. Maxillary repositioning and fixation proceeded as usual (Fig 4). The technique is summarized in the supplementary video file online.



**FIGURE 3.** Immediate downfracture of the maxilla is achieved by inwardly rotating the osteotome (arrow).

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**FIGURE 4.** The procedure is successfully completed through a minimally invasive incision.

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## Results

The studied sample consisted of 820 women and 477 men. Mean age at the time of surgery was 28.4 years (range, 12 to 67 years).

In 985 cases, a bimaxillary surgery was performed; the remaining 312 cases underwent an isolated Le Fort I maxillary osteotomy. In all cases, an effective downfracture of the maxilla was achieved with the twist technique; there was no need for conversion to the classic pterygomaxillary dysjunction. In total, 733 patients required further maxillary segmentation in 3 to 4 pieces, which was successfully achieved using the same approach as in nonsegmented cases. Mean surgical time of the maxillary procedure (from incision to last suture) was 44 minutes (range, 31 to 72 min). Mean incision length was 2.8 cm (range, 2.2 to 3.9 cm). Mean maxillary advancement was 5.5 mm (range, 2.0 to 14.0 mm). In total, 485 patients required third molar extraction at the time of orthognathic surgery. In these cases, the third molars were extracted using a standard occlusal approach before initiating the Le Fort I osteotomy procedure.

Patients were discharged from the hospital within an average period of 18 hours (range, 8 to 24 hr). There was no need for blood transfusion. No postoperative infectious complications occurred. Similarly, no clinically evident iatrogenic fractures or significant neurovascular complications were noted. However, 488 patients reported temporary numbness of the infraorbital nerve, which resolved within an average period of 6 days (range, 3 to 15 days).

## Discussion

Unlike classic pterygomaxillary dysjunction, which entails a lateral approach to the pterygomaxillary fis-

sure with a curved osteotome, the twist technique seeks to achieve pterygomaxillary dysjunction from a frontal approach with a straight osteotome. Downfracture is achieved by inwardly rotating the osteotome that has been previously fixed at the zygomatic buttress by sliding the osteotome backward along the lateral osteotomies. Separation of the maxilla is completed instantly. Successful maxillary separation from the cranial base can be verified under excellent direct vision and the greater palatine neurovascular bundle may be dissected easily. Lateral vision is adequate to enable an equilibrated elimination of bony interferences and assure good bone-to-bone contact.

This modified approach enables a substantially smaller soft tissue incision (2.8 cm on average) than the classic “molar-to-molar” exposure. The risk of ischemic events is minimized by the preservation of most of the vascular supply to the bone through the buccal corridors. In addition, the final visible scar on the buccal mucosa is significantly smaller. Despite this minimally invasive approach, the present results indicated that the procedure is perfectly feasible under the required conditions of patient safety and technical accuracy, including cases in which maxillary segmentation is required. It must be noted, however, that decreasing the incision length should be considered a technical progression from the classic approach and not a primary goal for the inexperienced orthognathic surgeon. That said, the twist technique is technically undemanding and is taught at the authors’ center as a standard method for pterygomaxillary dysjunction. Similarly, in cases in which significant scar tissue or abnormal anatomy is anticipated, such as patients with cleft or syndromic cases, a wider incision is recommended, although maxillary mobilization can still be achieved safely and efficiently with the twist technique.

Potentially severe complications after pterygomaxillary dysjunction have been reported in the scientific literature.<sup>2,4,7-10</sup> Many of these complications have been caused by malpositioning the osteotome or by accidental fractures during maxillary downfracture.<sup>4</sup> Although several technical modifications have been proposed to minimize the risk of pterygoid process fracture,<sup>7,11-18</sup> studies of strain distribution with different osteotome designs have indicated that pterygoid plate fractures are likely to occur regardless of the type of osteotome used.<sup>19</sup> Similarly, they occur irrespective of the use or nonuse of a pterygoid chisel.<sup>10</sup> At any rate, a pterygoid plate fracture cannot be considered a complication because it is not necessarily the cause of hemorrhage or nerve injury.<sup>4,10</sup> In fact, intentional fracturing of the pterygoid process is occasionally necessary when maxillary repositioning is hindered by interference with the pterygoid pro-

cess.<sup>4</sup> Despite the authors' clinically favorable results with no significant complications in a long series of patients, an ongoing study will try to specify the particular radiologic characteristics—if any—of pterygomaxillary dysjunction as achieved by the twist technique.

Regarding the limitations of the minimally invasive Le Fort I procedure described in this report, the authors differentiate two aspects: incision length and twist technique maneuver. In cases in which significant scar tissue or an abnormal anatomy is expected, such as patients with cleft or syndromic cases, a wider incision is preferred for safety reasons. In addition, although the authors' minimally invasive incision poses no limitations to the magnitude of maxillary advancement or clockwise rotation, significant anticlockwise maxillary rotation is managed with posterior plating and, hence, requires 1 to 2 cm broadening of the incision to enable proper access to the zygomaticomaxillary buttress. It must be noted that, when indicated, third molar extraction is always performed from an occlusal approach before the Le Fort I procedure. The twist technique of pterygomaxillary dysjunction is a safe, efficient, technical modification for maxillary downfracture. In the authors' experience, no particular limitations or contraindications must be acknowledged.

Compared with classic pterygomaxillary dysjunction, the twist technique uses a frontal approach and a straight osteotome. Downfracture is achieved by inwardly rotating the osteotome that has been fixed at the zygomatic buttress. This modified approach enables a substantially smaller soft tissue incision, achieves an immediate effective separation of the maxilla, and enables adequate visualization of the greater palatine neurovascular bundle. Preliminary experience in more than 1,200 patients indicates the procedure meets the necessary requirements of safety and technical accuracy.

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## Appendix

### Supplementary Data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.joms.2012.04.032>.