An accurate maxillary superior repositioning technique without intraoperative measurement in bimaxillary orthognathic surgery


Abstract. This article describes a simple and accurate technique for maxillary superior repositioning without any intraoperative measurement using reference points that can be the source of error in bimaxillary orthognathic surgery. A bilateral straight locking miniplates (SLMs)/screw system secured to the maxilla and mandible maintains the three-dimensional relationship between the mandible and the skull base precisely like the incisor pin of an articulator in model surgery. The maxilla can then be accurately moved into the planned position identical to that in model surgery by the SLMs technique.

Key words: accurate maxillary superior repositioning; bimaxillary orthognathic surgery.

Accepted for publication 23 March 2012
Available online 25 April 2012

Inaccurate positioning of the maxilla leads to less than ideal functional and aesthetic outcomes in orthognathic surgery. Previously reported techniques for positioning the maxilla required intraoperative measurement using internal and external reference points.1-3 These intraoperative measurement techniques have been shown to be clinically reliable, but for accurate repositioning, intraoperative measurement often has to be repeated several times until the maxilla is moved into the planned position, which is time-consuming and troublesome. It is still difficult to exclude the possibility of error incidental to the measurement procedure, even if it is performed by experienced surgeons with the utmost care, especially during multidirectional moves.

The authors introduced a simple technique with straight locking miniplates (SLMs) for accurate maxillary superior repositioning without any intraoperative measurement. This technique is based on the principle that three-dimensional (3D) positioning of the maxilla can be achieved precisely if the vertical dimension from skull base to mandible is kept constant during splint fabrication in model surgery and transoperative time. During model surgery, the incisor pin of the articulator maintains the vertical dimension from the skull base to the mandible, and during surgery, SLMs secured to the maxilla and mandible maintain the vertical dimension like the incisor pin of the articulator.

Technique

The centric relation of the condyle (CR) is confirmed by radiographs (Schüller) and a
CR-guiding interocclusal wafer is fabricated preoperatively. The models are mounted on a semi-adjustable articulator by face-bow transfer. Maxillary model surgery is performed. The maxillary cast is moved in 3D planes within the articulator according to the predictive tracings. The surgical splint is fabricated by filling the space created on maxillary movement between the maxillary and mandibular casts, which are fixed in the centric condylar position. This splint is used as an intermediate during surgery.

Before down-fracture, the maxillo-mandibular complex with interpositioning wafer guiding CR position is fixed by SLMs bilaterally. The plates are fixed to the zygomatic buttress above the Le Fort I osteotomy borderline and the proximal segment of the mandible, and secured with two screws on each side (Fig. 1). SLMs maintain the vertical distance between the skull base and the mandible and can reproduce centric condylar positioning throughout the surgery.

After removal of SLMs, a standard Le Fort I maxillary down-fracture is performed. The maxilla is then mobilized. Bone that interferes with desired repositioning of the maxilla is removed with a small round bur. The maxilla is placed in the planned position using an intermediate splint. SLMs are fixed bilaterally only on the side of the mandible. If any further bony interference is present, SLMs cannot be fixed to the previous position on the side of the maxilla (Fig. 2). In that case, additional bone removal should be carried out until the screw holes of the SLM match with the corresponding holes drilled previously on the zygomatic buttress. When SLMs are secured with two screws bilaterally, the maxilla can be moved into the planned position accurately as in the model surgery. SLMs act as temporary fixation of the maxilla, keeping it in the new position without manual control. The maxilla is fixed with 2.00 mm L-shaped, short, straight miniplates at the piriiform rim and anterior wall bilaterally (Fig. 3).

After fixation of the maxilla, the SLMs are removed and mandibular setback is performed by standard bilateral sagittal split ramus osteotomy. Maxillomandibular fixation is applied with the final splint in occlusion and the SLMs are placed in the same position to set the condyles in centric relation. SLMs maintain the proximal segment with the condyle in position without manual control. A rigid fixation of proximal and distal segments is applied (Fig. 4). After removal of the SLMs, maxillary fixation at the zygomatic buttress is added. The postoperative occlusion is stable and reproducible with only two light intermaxillary elastics.

**Discussion**

Based on the principle that 3D positioning of the maxilla can be achieved precisely if the vertical dimension from skull base to mandible is kept constant during splint fabrication in model surgery and transoperative time, Gil et al. reported a technique using intermediate splints and Kirschner wire (K-wire) which is used to obtain the distance between the hole above the Le Fort I osteotomy and the most apical point of the gingival margin of the right mandibular canine. The present method may have several advantages over Gil’s technique, although the principle is similar. SMLs with four locking screws play the role of the incisor pin of the articulator instead of K-wire. SLMs can maintain the 3D relationship between the mandible and the skull base more precisely than the K-wire, leading to more accurate maxillary repositioning. It has been reported that locking miniplate/screw systems provide greater stability than conventional non-locking ones, and more than K-wire. Without accurate repositioning of the maxilla identical to that in model surgery, SMLs cannot be placed in the same position using the same holes of the buttress drilled before down-fracture. In this technique, accuracy of maxillary repositioning does not depend on the measurement, which is one of the possible causes of surgical error.
Even if accurate positioning is confirmed by intraoperative measurement or K-wire, the maxilla must be kept in that position manually until rigid fixation is completed. There might be cases in which it is difficult to maintain the position manually without displacement of the maxilla from the measured position. When using the SLMs technique, it is not necessary to maintain the maxillary position manually. Just as the maxilla is repositioned accurately, it is temporarily fixed by SLMs in that position.

Furthermore, SMLs can act as a condylar positioning device. Various techniques for condylar positioning have been reported, but there has been no report of a technique that controls the position of both the maxilla and mandible simultaneously. After sagittal split ramus osteotomy, the relationship between the proximal segment with the condyle and the skull base is maintained by SLMs.

This method does not require intraoperative measurement or any special device except for commonly used locking miniplates. Using the SLMs technique, the complex procedure of bimaxillary orthognathic surgery can be simplified and the outcome of surgery will be more predictable even if performed by a less-experienced surgeon.

**Fig. 3.** After SLMs are secured with two screws bilaterally, the maxilla is kept in the new position without manual control. The maxilla is fixed with 2.00 mm L-shaped, short, straight miniplates at the piriform rim and anterior wall bilaterally.

**Fig. 4.** SMLs can act as a condylar positioning device. These maintain the proximal segment with the condyle in position without manual control. A rigid fixation of proximal and distal segments is applied.