Pre-bent buccal distractor made from a 3D model for maxillary anterior segmental distraction osteogenesis for precious fit and decreasing surgical time

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Abstract

Maxillary anterior segmental distraction osteogenesis surgery involves a distraction segment that is made at the anterior part of the maxilla. Although bending and fitting the distractor during surgery is a complex procedure, we present here a usefulness of the pre-bent distractor made with a 3D model for precise fixing and reducing operative time.

Key Words: Pre-bent buccal distractor, 3D model, maxillary anterior segmental distraction osteogenesis, precious fit

Maxillary anterior segmental distraction osteogenesis (MASDO) surgery involves a distraction segment that is made at the anterior part of the maxilla and advanced anteriorly using two intraoral buccal distractors. The posterior part of the maxilla is preserved and velopharyngeal function is not affected in cleft lip and palate patients. The main advantage of MASDO compared with Le Fort I advancement is that the maxilla is advanced without affecting speech from lengthening the maxilla [1, 2]. Although bending and fitting the distractor during surgery is a complex procedure, a pre-bent distractor made with a 3D model is useful for precise fixing and for preventing root injury and reducing operative time. To the best of our knowledge, only one report has described the use of a pre-bent distractor for Le Fort I advancement [3].

High-resolution computed tomography (CT) scans (slice thickness <2 mm) of the maxillofacial skeleton were obtained and sent to Ahead laboratories Inc. (Tokyo, Japan) for fabrication of the 3D model. Plaster medical rapid prototyping (MRP) models were obtained using powder bed and inkjet head 3D printing (Zprinter 310+, 3D systems, Rock Hill, USA) [4]. Both titanium vertical distraction devices (multi-tooth devices, W. Lorenz, Jacksonville, USA) were bent and fitted to the 3D models after deciding the osteotomy line (Figure 1 and 2). The bilateral rods need to be parallel so that they do not interfere with advancement and they need to be parallel to the occlusal plane, if possible. The finished distraction devices were sterilized by autoclaving before surgery.

Surgery was performed under general anaesthesia with oral intubation and fixation at the midline to prevent tube burst with a surgical saw. An incisional line was made for cleft patients to maintain blood supply to the maxillary bone from the surrounding membrane. The incision was made on the palatal mucosa along the gingival sulcus, and a palatal mucoperiosteal flap tunnel was made to expose the palatal osteotomy line. To expose the buccal osteotomy line in front of the first molar, a vestibular vertical incision was made. Before osteotomy, the two buccal pre-bent distractors were fixed with 4 or 5 mm screws to avoid tooth roots (Figure 3). The osteotomy line was marked between two plates of the distractor; this space was separated before surgery by an orthodontist. Once the distractors were removed, osteotomy was performed in accordance with the planned buccal bone, the external bone of the nasal cavity, the alveolar bone in front of the first molar, and the palatal bone using a surgical saw and chisel. Separation of the nasal septum from the nasal base and down fracture of the anterior segment was performed. After acquiring sufficient mobility, the two distraction devices were re-fixed and the wound was closed. The median surgical time of recent 7 cases was 2:16 (2:04 - 2:43). The distractors were activated 0.5 mm twice a day

(1.0 mm per day) after a 3-day latency period (Figure 4) [1]. The distractors will be removed for 2 or 3 months after completing planned distraction osteogenesis and the new bone develops (Figure 5).

References

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Figure legends

Figure 1. Lateral view of 3D model with fitting of two titanium distraction devices.

Both titanium distraction devices were bent and fitted to the 3D model after deciding the osteotomy line.

Figure 2. Frontal view of 3D model with fitting of two titanium distraction devices.

The bilateral rods need to be parallel so that they do not to interfere with advancement. The rods also need to be parallel to the occlusal plane.

Figure 3. Intraoral view fixing two buccal pre bent distractor before osteotomy.

Before osteotomy, the two buccal pre-bent distractors were fixed with 4 or 5 mm screws to avoid tooth roots.

Figure 4. Post distraction Panorama x-ray.

The distractors were activated 0.5 mm twice a day (1.0 mm per day) following a 3-day latency period. The distractors will be removed for 2 or 3 months after completing planned distraction osteogenesis and the new bone develops.

Figure 5. Panorama x-ray after removal of distractors.

The distractors were removed for 3 months after completing planned distraction osteogenesis and the new bone develop.

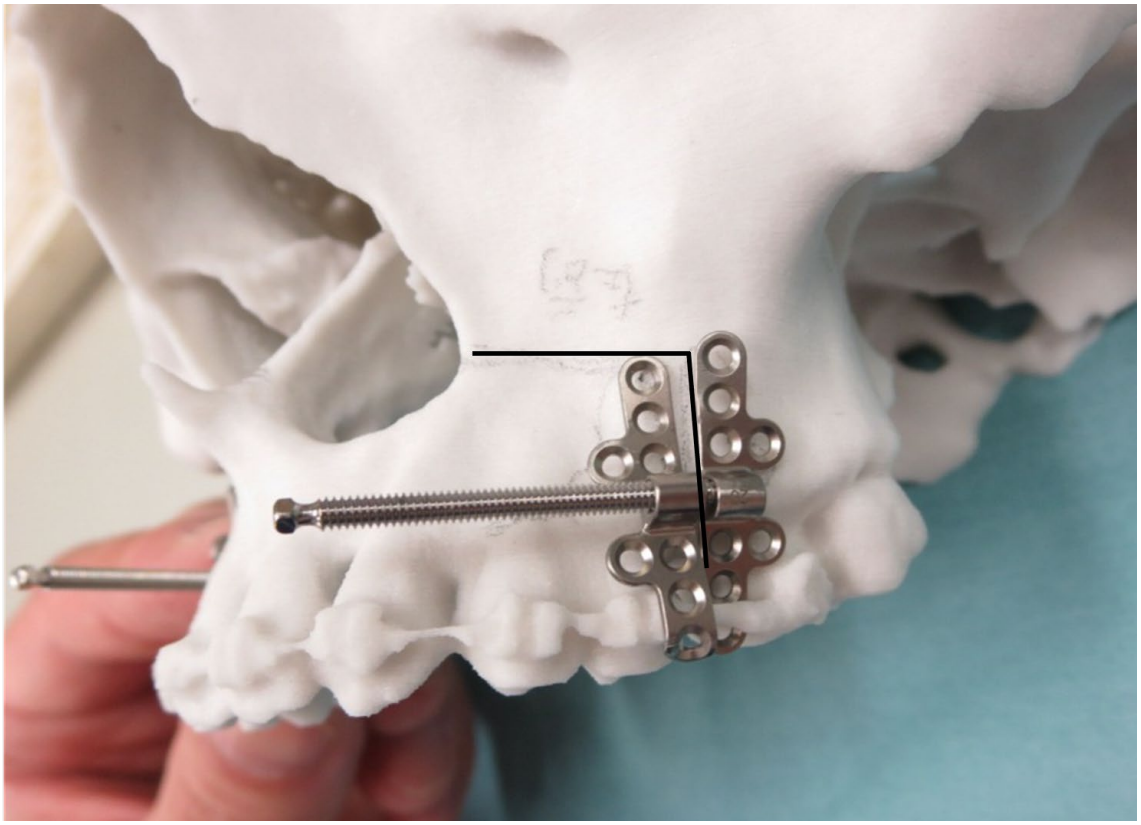

Fig. 1

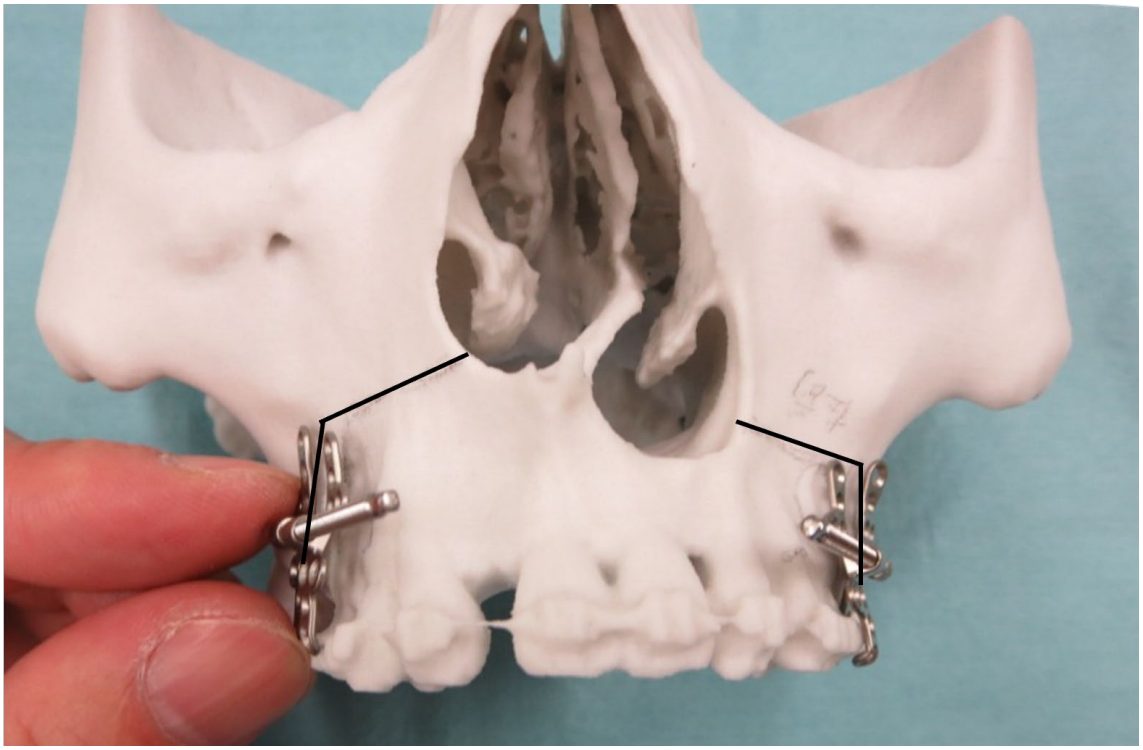

Fig. 2

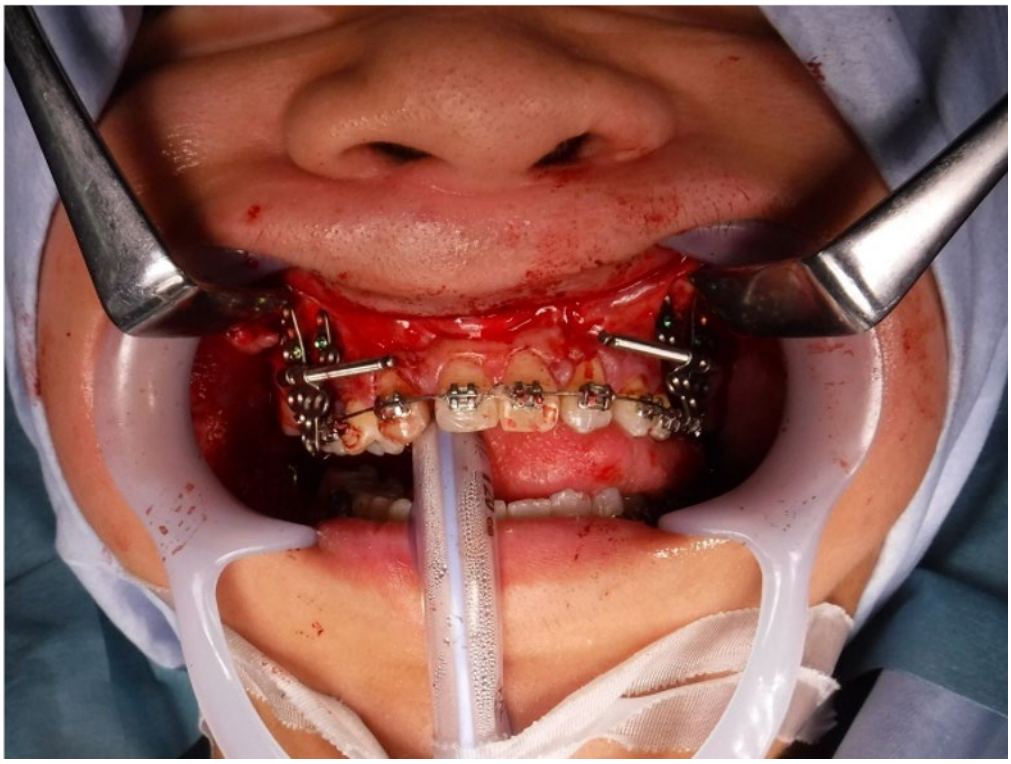

Fig. 3

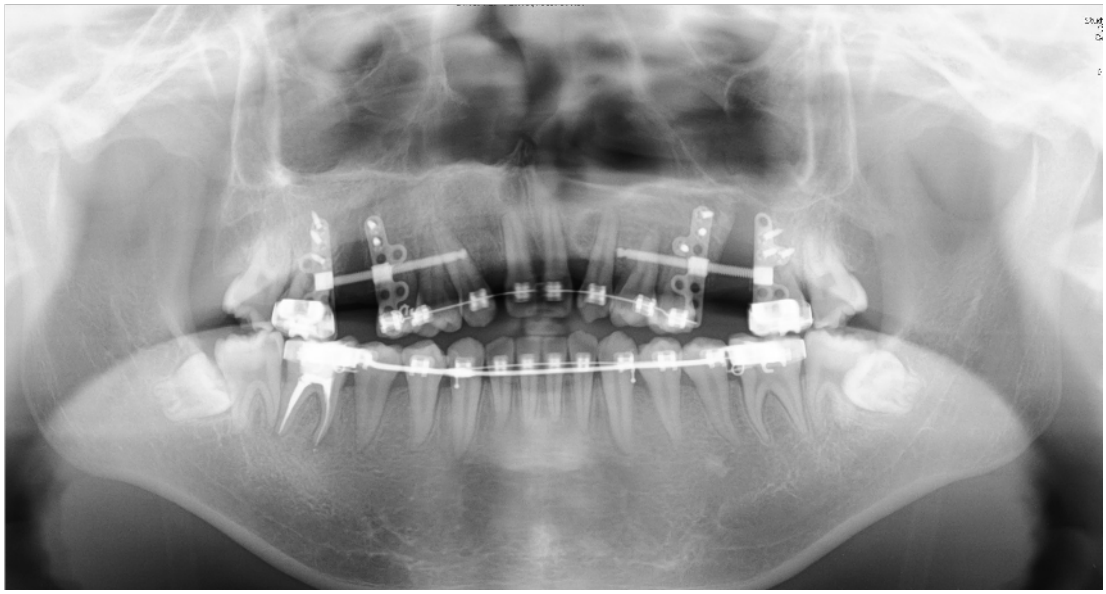

Fig. 4

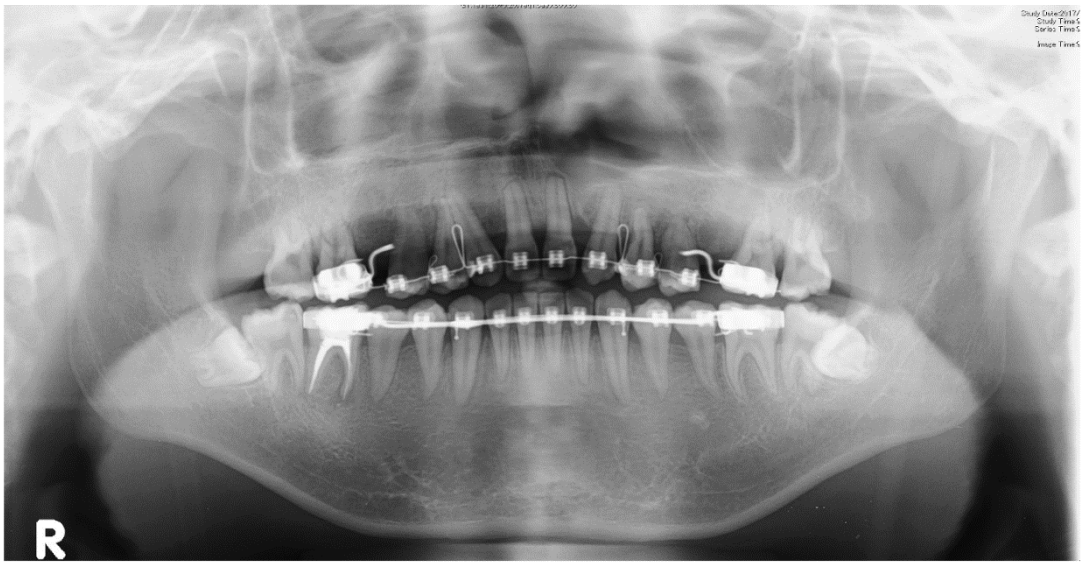

Fig. 5