

Technical note

Simple patient-specific instrument for intraoral vertical ramus osteotomy

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In intraoral vertical ramus osteotomy (IVRO), identification of the mandibular foramen is critical to safeguard the mandibular nerve.¹ However, identification of the mandibular foramen from a lateral view of the ramus using anatomical landmarks is inaccurate.^{2,3} Correct positioning of the osteotomy is difficult because of the limited visualisation of the operation field, particularly in cases with a round-shaped ramus. Although several techniques are available for guiding the bone-cutting line,^{4,5} definitive standards have yet to be established. We developed a simple surgical guide using patient-specific instruments (PSIs) created by 3-dimensional printing to avoid the mandibular nerve.

We used this technique for six patients with mandibular prognathism. We obtained CT image data for the craniofacial area of each patient, with a slice thickness of 0.5 mm (Toshiba Alexion, Toshiba). Data were imported into ProPlan CMF version 3.01 software (Materialise) and the image was reconstructed as 3-dimensional computer graphics (3DCG). On the lateral ramus of the 3DCG, we simulated the osteotomy line posterior to the antilingula, directed superiorly to the sigmoid notch and inferiorly to the anterogonial notch (Fig. 1). The

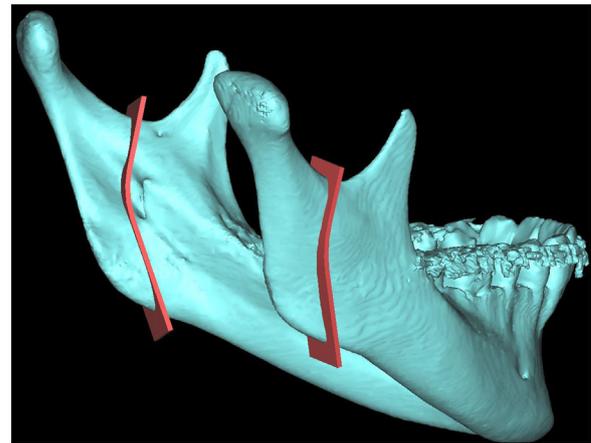


Fig. 1. Osteotomy line on the 3-dimensional computer graphics.

PSI was designed with a thickness of 2.0 mm, covering the anterior side of the mandibular foramen, and fitted by making undercuts in the sigmoid notch, anterogonial notch and anterior margin of the ramus (Fig. 2).

The 3DCG of the PSI was sent to a 3-dimensional printer (Inventor; FLASHFORGE). Glycol-modified polyethylene terephthalate (Taulman3D guideline; Taulman3D) was used as a material (Fig. 3).

IVRO was accomplished as described previously¹, with some modification to identify the osteotomy line. After

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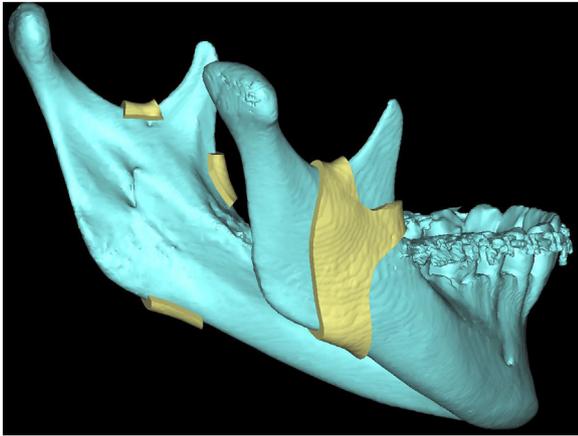


Fig. 2. The patient-specific instrument (PSI) covering the anterior side of the mandibular foramen, and fitted by making undercuts.



Fig. 3. The PSI made of glycol-modified polyethylene terephthalate.

detaching surrounding tissue from the lateral ramus, the PSI was fitted, and the initial point of osteotomy was made exactly along the posterior rim of the PSI by a securely caught oscillating saw (Fig. 4). After osteotomy of the initial point, the osteotomy was done in the direction of the sigmoid notch and anterogonial notch. No patients experienced neurosensory disturbance of the mandibular nerve.

Although the antilingula and mid-waist point of the ramus are used as anatomical landmarks corresponding to the mandibular foramen,^{1–3} these points are often difficult to identify in the surgical field. Further, these methods using anatomical landmarks can be inaccurate.^{2,3} The osteotomy line used was not based on unreliable anatomical landmarks, but instead on individual 3-dimensional models of each patient.

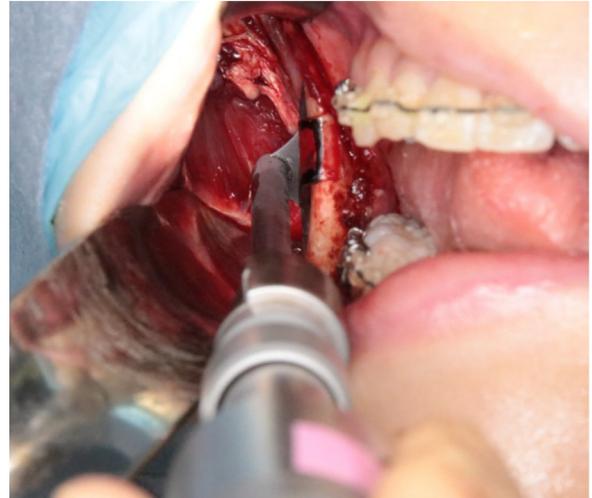


Fig. 4. The osteotomy was made along the posterior rim of the PSI by an oscillating saw.

Using the new techniques, no difficulty was encountered in identifying the osteotomy line. This technique makes bone cutting easier and safer, even for less experienced surgeons.

Conflict of interest

We have no conflicts of interest.

Ethics statement/confirmation of patient's permission

The research protocol was approved by the Ethics Committee of Kyushu Dental University (18-44), and all patients provided informed consent to participate. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5).

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