

TECHNICAL NOTE

Rigid fixation of intraoral vertico-sagittal ramus osteotomy for mandibular prognathism.

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The standard surgical treatment for prognathism is sagittal split ramus osteotomy (SSRO) if the proximal and distal segments of the ramus require fixing with screws or metal plates. In this procedure, however, it is frequently difficult to avoid neurosensory disturbance (NSD) of the inferior alveolar nerve (IAN) when the posterior margin of the ramus curves inward or when the ramus is thin (Fig.1-A, B). We propose a new alternative procedure, intraoral verticosagittal ramus osteotomy (IVSRO),¹ a modification of SSRO and intraoral vertical ramus osteotomy (IVRO). One of the main advantages of IVSRO is that it avoids IAN damage, because the ramus can be split parallel to the original sagittal plane posterior to the point between the mandibular canal and the lateral cortical bone plate immediately in front of the antilingual prominence. Another advantage of IVSRO is that the area in which screws can be inserted is relatively large, if the subcoronoid area on the distal segment and subcondylar area on the proximal segment are used. Both segments can be fixed in these areas with bicortical bone screws, with or without a cheek incision (Fig.1-C). Here, we introduce

the rigid fixation of intraoral verticosagittal ramus osteotomy for mandibular prognathism.

Technique

Osteotomy of the ramus in IVSRO is a modified version of straight IVSRO and extended IVSRO for advancement of the mandible.¹ Briefly, the lateral aspect is exposed from the sigmoid notch to the antegonial notch. To avoid damaging the IAN and the maxillary artery, the medial aspect of the ramus may also be exposed carefully from the sigmoid notch area to the lingula and the posterior border of the ramus,³ as in SSRO. To avoid a fracture or bad split, the full thickness of the sigmoid notch is cut with a fissure burr, reciprocating saw, or oscillating saw inferiorly along the planed decortical line until the bone marrow is exposed. This process, full-thickness cutting of the sigmoid notch, is the most important and most technically difficult step of the IVSRO procedure. A wedge-shaped decortication of the lateral aspect of the ramus from the sigmoid notch to the antegonial notch is performed using a flat top, cylindrical fissure burr parallel to the original sagittal plane, until the bone marrow is exposed². An osteotome and a bone spatula are utilized for vertical osteotomy along almost the entire sagittal plane to the medial posterior border of the ramus. The distal segment is then

repositioned posteriorly, and maxilla-mandibular fixation (MMF) is performed. The inner aspect of the decorticated distal segment is spontaneously overlapped with the proximal segment. The subcoronoid area and the subcondylar area in each segment are also overlapped. Both segments can be fixed using bicortical bone screws. If possible, we use a 90° screwdriver system (for example, angled drilling system and insertion screws; 12 mm screw length; Synthes, com.) with an intraoral procedure (Fig. 2-A, B and C). When both segments are fixed rigidly, MMF is usually not required after surgery. However, favorable outcome is usually obtained with MMF for about 3 days to prevent postoperative bleeding and to aid in wound healing. To stabilize the occlusion postoperatively, intermaxillary elastics are applied for about 2 months after release of MMF.

Discussion

The main advantage of rigid fixated IVSRO over SSRO in treating prognathism when the posterior margin of the ramus curves inward or the ramus is thin may be the reduced risk of postoperative NSD. The incidence of long-term NSD of the lower lip and chin in IVSRO was 0% – 6%^{1, 11-12} compared with 39% – 85% for SSRO.⁴⁻⁸ Although the osteotomy plane is between the mandibular canal and the lateral cortical

plate of the ramus, as in SSRO, damage to the IAN can be avoided because the osteotomy is performed from a point in front of the foramen between the mandibular canal and the immediately medial lateral cortical bone,^{1,9} making it likely to strip the lateral cortical bone from the bone marrow. Although a low incidence of NSD is also observed with IVRO,^{7,13} rigid fixation with screws or bone plates has several disadvantages, including technical difficulty^{7,14} and the rotation of the condyle to the lateral side.¹ IVSRO is distinguished by flat and larger contact areas of the segments and a more favorable healing situation of medulla-to-cortex than the cortex-to-cortex healing of IVRO¹

In SSRO, the excess overlap of the anterior edge of the proximal segment must be removed to fit both segments and/or to prevent distal rotation of the proximal segment.^{1,}

¹⁰ In IVSRO, there is no excess overlap of the proximal segment.

It is easy to check the position of the distal segment after osteotomy because the anterior area of the proximal segment is removed beforehand; hence, the subcoronoid area of the distal segment and the subcondylar area of the proximal segment can be used for insertion of screws. The area available for screw insertion is relatively large and the ends of the inserted screws may be viewed at the medial aspect of the distal segment because, at the internal oblique ridge, the bone thickness of this subcoronoid area in the

distal segment is relatively thin compared with the retromolar areas as in SSRO.

Therefore, in many patients, a 90° angled screwdriver system with 12 mm screw length can be used without drilling through a trocar inserted through the skin (Fig.3-A, B and C).

When planning rigid fixation using IVSRO, the following two conditions are preferable: 1) mandibular setback (about 5 mm or more), 2) counterclockwise rotation. As this osteotomy procedure has a large contact area between the proximal and distal segments compared with IVRO, the segments are fixed usually with screws in only the setback side in case of horizontal rotation for mandibular asymmetry (Fig.2-C).

Additional studies including the development of osteotomy instruments and drilling systems to simplify the surgical procedure of IVSRO are needed to validate the advantages of this procedure.

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Figure legends

Figure 1. Axial image of CT film in the left mandibular ramus

A, B: Preoperative image; SSRO is more difficult if the posterior border of the mandibular ramus curves inward or the ramus is thin. C: Postoperative image of rigid fixation with screws in cases A. The anterolateral cortical bone of the proximal segment is removed (arrow) and osteotomy is performed from a point between the mandibular canal and the lateral cortical bone. The proximal and distal segments are fixed using bicortical bone screws (arrowhead).

Figure 2. Surgical procedure of IVSRO.

A: 90° screwdriver system (Black arrow; angled drilling system; Synthes, com.) and B: insertion screws (White arrow; 2.4 mm in diameter, 12 mm screw length) were used with an intraoral procedure. C: postoperative image of the case Fig.2. The distal segment of mandible was rotated to the left side in the case of mandibular deformity. Rigid fixation was performed in left side.

Figure 3. Rigid fixation of IVSRO using a mandibular model.

Lateral (A) and anterior (B) views of the left mandibular ramus. Screws can be inserted

into the subcoronoid area on the distal segment and the subcondylar area on the proximal segment. Medial view (C), showing that the area of screw insertion is relatively large (dotted line).

Figure 1. A



Figure 1. B



Figure 1. C

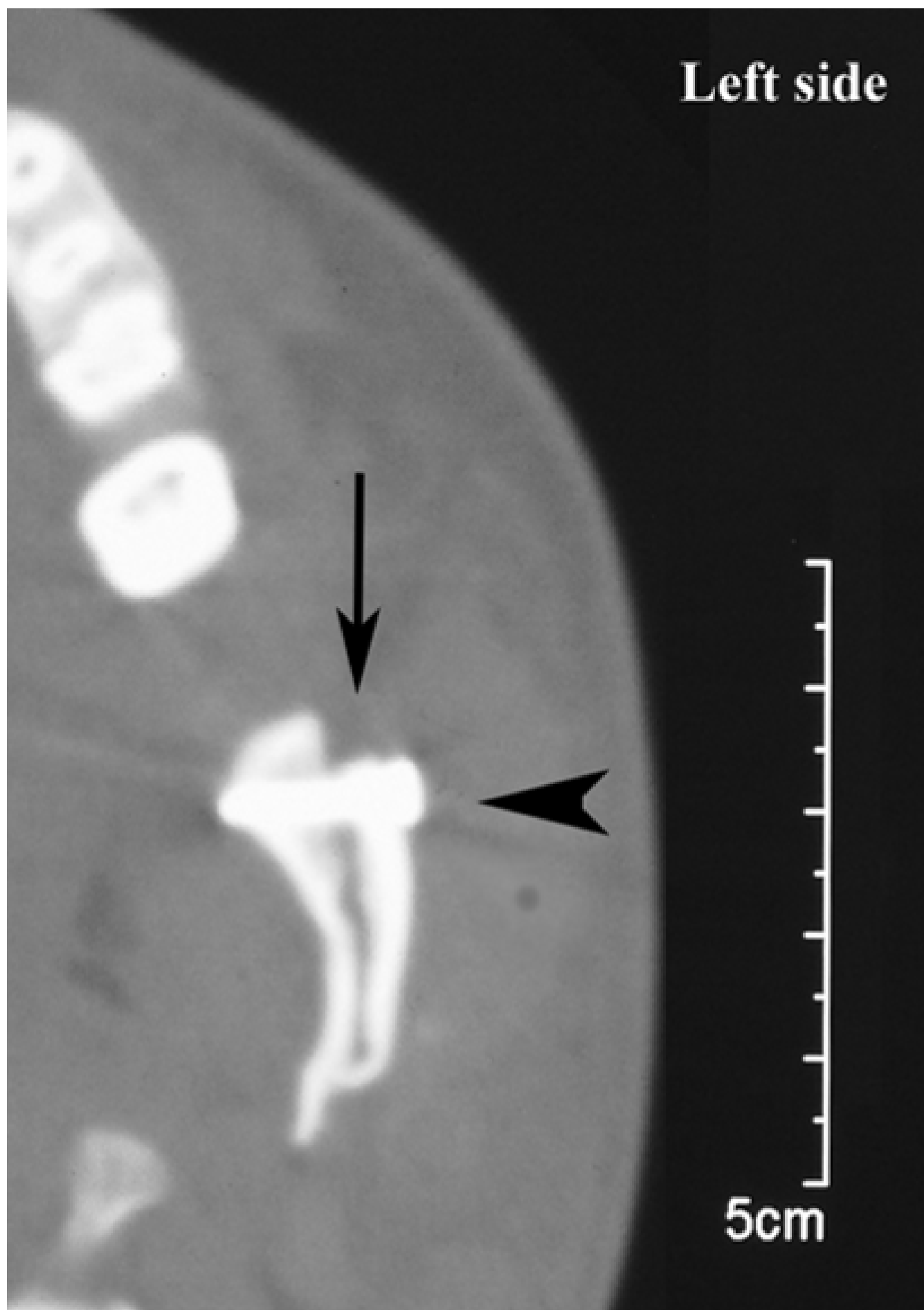


Figure 2. A

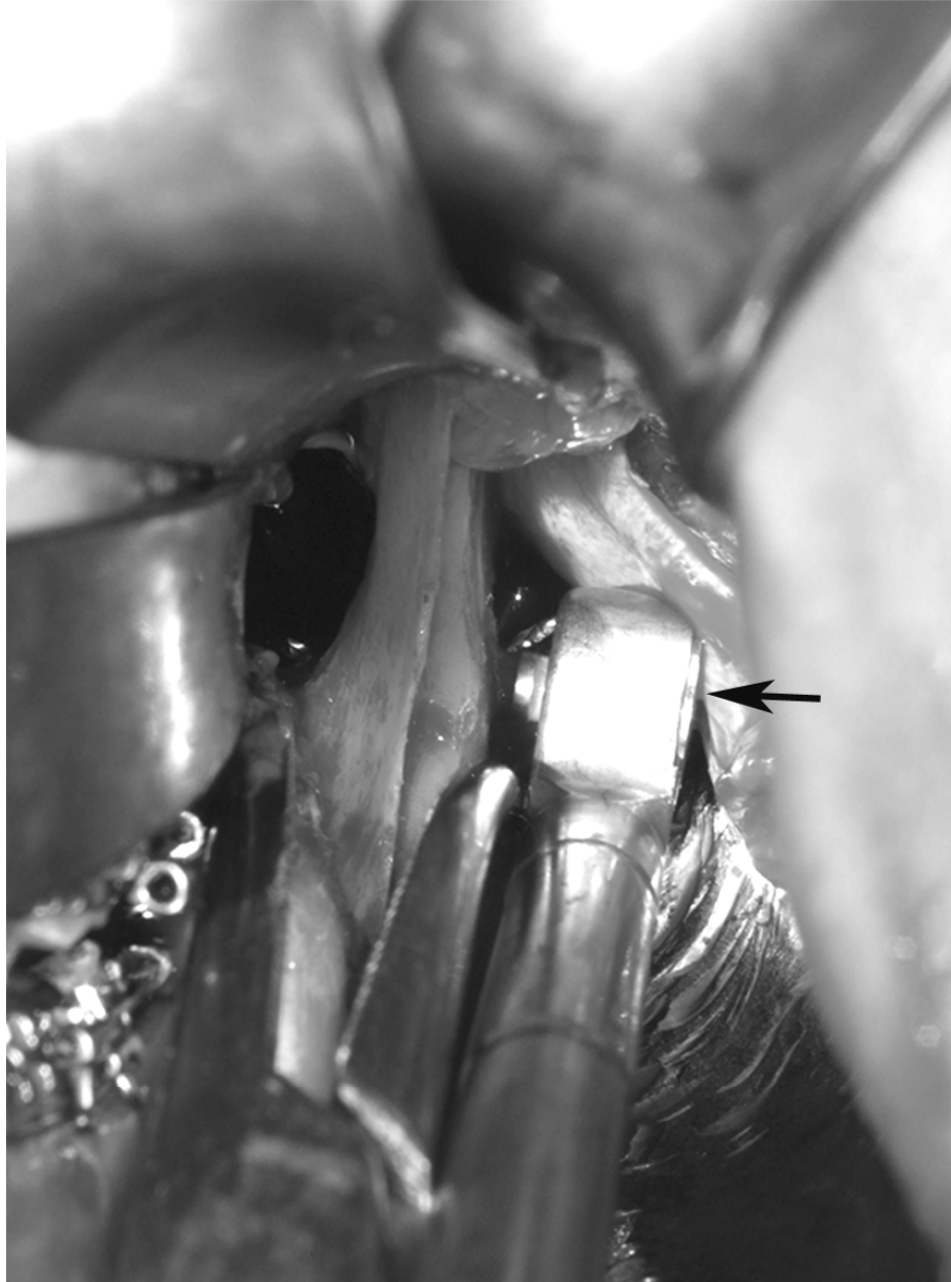


Figure 2. B



Figure 2. C

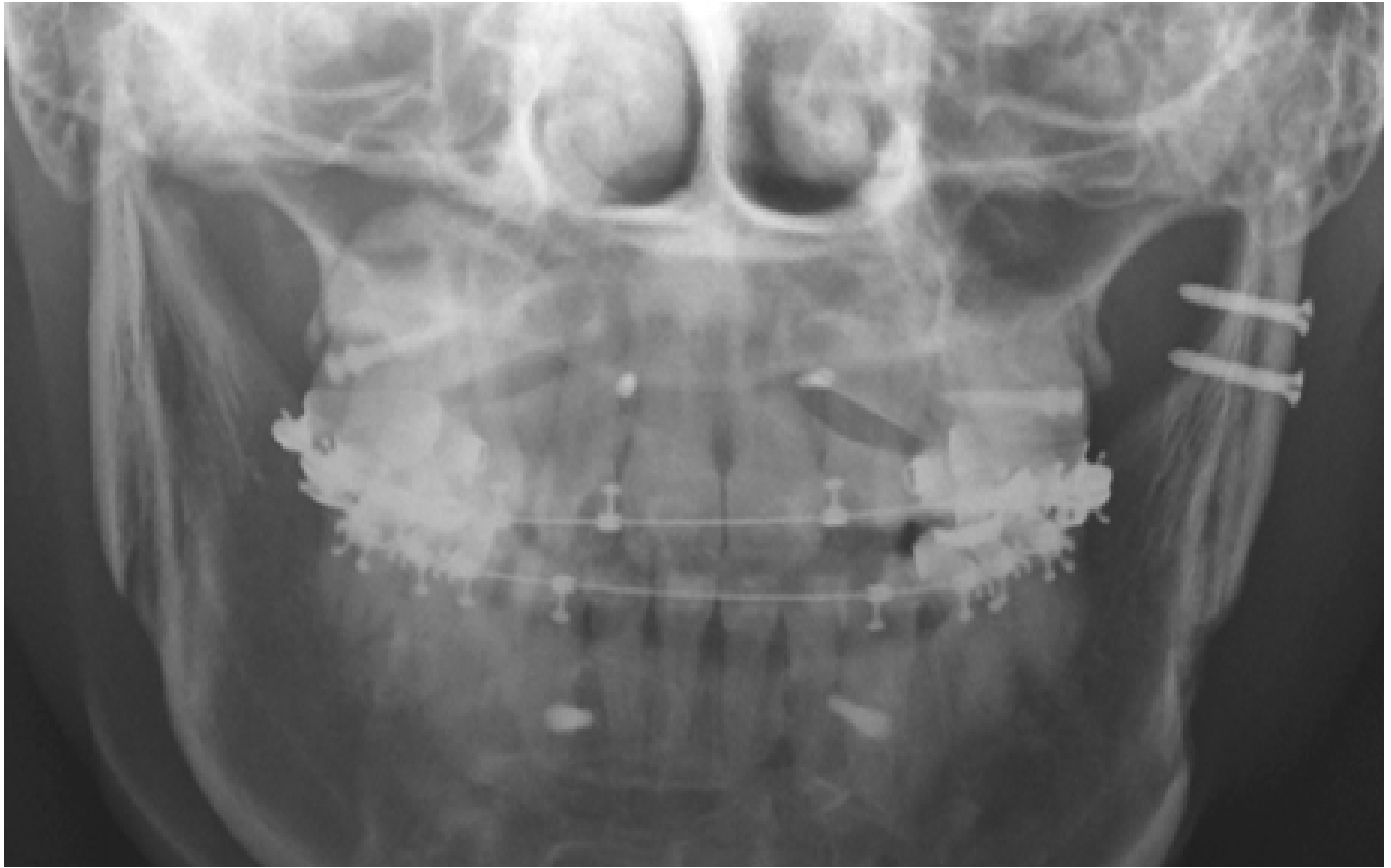


Figure 3. A



Figure 3. B



Figure 3. C

